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ABSTRACT

The selections in this collection explore topics related to the future of information technology and strategic, academic, resource, and facilities planning in institutions of higher education. Part 1, "Developing the Vision: Principles, Paradigms, Life Cycles, and Values," contains: (1) "Mega-Level Strategic Planning: Beyond Conventional Wisdom" (Roger Kaufman and Dale W. Lick); (2) "Change Creation: The Rest of the Planning Story" (Dale W. Lick and Roger Kaufman); (3) "Academic Leadership Strategies: Partnerships for Change" (Gretchen M. Bataille); and (4) "Technology's Contributions to Academic Planning" (J. Thomas Bowen). Part 2, "Implementing the Vision: Principles, Strategies, and Curricula,: contains: (5) "Academic Planning and Technology" (David G. Brown); (6) "The Impact of Technology on Institutional Planning" (Ellen-Earle Chaffee); (7) "Cycles in Curriculum Planning" (John E. Kolb, Gary A. Gabriele, and Sharon Roy); and (8) "Does a College Curriculum Have a Life Cycle?" (John T. Harwood). In part 3, "Supporting the Vision: The Campus Digital Plan," the chapters are: (9) "Planning for IT in Higher Education: It's Not an Oxymoron" (John W. McCredie); (10) "Life-Cycle Costs: More Than the Cost of Hardware" (Christopher S. Peebles); and (11) "Virginia Tech Faculty Development Institute" (John F. Moore and J. Thomas Head) with "Planning Practice: The IT Staffing Puzzle" (Martin Ringle) and "Planning Practice: Community-Based Planning for Technology" (R. Dan Walleri). Part 4, "Integrating the Vision: Physical and Digital Learning Environments," contains: (12) "IT Considerations in Facilities Planning" (Joel L. Hartman); (13) "Planning for Classroom Technology" (Margaret McDermott and David E. Hollowell); and (14) "Developing and Supporting High-Technology Facilities" (Bruce M. Taggart), with "Planning Practice: From Blueprints and Spreadsheets to the Web" (Patricia Seller-Wolff and Mark Wells) and "Planning Practice: New Tools for Community College Facilities Planning" (Patricia C. Williamson). A conclusion, "Realizing the Vision: Concluding Thoughts," summarizes some of the major points. Each chapter contains references. (SLD)

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Technology-Driven Planning:

Principles to Practice

Edited by
Judith V. Boettcher
Mary M. Doyle
Richard W. Jensen

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Preface

There is no doubt that the dawn of the 21st century will be remembered as a dynamic time in college and university planning. The fast-paced progress of information technology continues to prompt changes in our structures, relationships, and funding models. It would be difficult to identify an institution of higher education that has not been touched by these changes.

All signs point to the continued evolution of information technology. Understanding change, planning for change, embracing change, and implementing change are among the key challenges of the 21st century for postsecondary education. These challenges must not only be met, they must also be successfully conquered if higher education is to maintain its historical roles in the delivery of instruction, research, outreach, and service to the world's citizens.

The Purpose of This Book

Given that information technology is becoming ubiquitous and rapid change inevitable in our organizations, there is a clear need to explore and understand the impact of information technology on strategic, academic, resource, and facilities planning in our institutions. In past decades, the management of technology in higher education was marginal to the main tools of higher education—the lecture, the presentation, books, articles, libraries, and so on. Today, it is central to both the material that is presented and to the means by which it is delivered.

This book examines a variety of ways to create clear pathways to the future. It presents a selection of topics that address both broad concepts related to planning and change, and specific cases and examples of how institutions are planning for and addressing change.

Because information technology has become such an integral part of our lives, we would be remiss if we did not employ technology in the presentation of the ideas presented herein. To that end, the companion Web site for this publication, www.scup.org/tdp, provides links to the numerous online resources referenced in the publication. At this site, you will also discover information about complementary activities such as online discussions with the authors and dates and places where the authors will discuss their experiences and ideas.

Who Should Read This Book

This book is intended as a resource for institutional managers and planners at many organizational levels. From state higher education leaders, coordinating councils, and legislative staffs to executive leadership responsible for designing strategies to meet institutional missions and visions to academic planners who must design a curriculum for the changing demands of society; information technology leaders who must plan, design, operate, and fund these changes; and facilities planners who are challenged by the rapidly changing technology requirements in physical spaces, this volume offers both theoretical and practical advice from a host of experts.

The book should be helpful to many planners in the way it sets a context for embracing change, prepares institutions to implement change, and describes the process of change with examples in strategic, curriculum, resource, and facilities planning venues. The chapters and planning practices included in this book represent public and private, large and small, two-year and four-year institutions.

The editors have no expectation that this volume will provide all the answers to dealing with the changes we are experiencing. We have, however, identified many of the most relevant questions and issues that our audience should examine. We sincerely believe there is something for every institutional planner and leader between these covers.

Judith V. Boettcher
Mary M. Doyle
Richard W. Jensen

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The editors would like to thank each of the contributors to this book. Among the authors are university presidents, provosts, vice presidents, chief information officers, and others who gave freely of their time and wisdom to provide thought provoking guidance for us as we struggle to keep up with our changing environment. We would also like to express thanks to the Society for College and University Planning, especially Sharon Morioka, for bearing with the seemingly endless duration of this project. We hope that in the end you will find it worth the wait. We would also like to thank and acknowledge Datatel for its sponsorship of this project. Datatel put a considerable amount of faith in our efforts and allowed us the freedom to produce a volume that reflects the SCUP message of the importance of "connecting the dots" in university planning.

SCUP wishes to thank Judith V. Boettcher, Mary M. Doyle, and Richard W. Jensen for their expertise, their dedication to this project, and their unflagging enthusiasm. SCUP also wishes to thank the following people in the preparation of this publication: designer Lori Young, Les Cheneaux Design; production artist Marc Johns; copyeditor Marcella Weiner; and proofreader Sandy Cyrus. In addition, SCUP acknowledges the sponsorship of Datatel in partially funding the publication of this book. It is SCUP's policy that sponsorship of any publication by a third party does not constitute an endorsement of the sponsor by SCUP, nor does it in any way interfere with SCUP's editorial standards or judgment.

Introduction

Framing the Vision: From Principles to Practice

Planning in higher education is no longer the specific responsibility of a small group of focused planners; it is the responsibility of every institutional leader. These institutional leaders reflect the many facets and demands on our institutions. From crafting state and system direction to determining the look of a new facility, planning involves senior administrators, analysts, faculty members, technologists, budget officers, governing boards, architects, engineers, and many others. While each of these constituent groups and stakeholders might have a different set of planning responsibilities, they have the same goal—to uphold and advance the mission and core values of their institution. The mission and core values of our institutions generally coalesce into a special vision of what an institution is and will be to its constituents. The vision provides a sense of where the institution is going. It's a collective attitude, an essence. It's what the institution is about, how it communicates the special way that it serves students and society. We ask you to keep in mind the concept of vision throughout this book as a touchstone of constancy for an institution. An institution's vision serves as a guide through the mists of swirling and sometimes, it seems, overwhelming change.

However, before you—as a leader—move forward with confidence that you have your institution's vision securely in mind, we suggest that it is time to pause and reflect on that vision. How long has it been since the leaders at your institution examined the mission, the vision of your institution? In the case of the land grant institutions, the Kellogg Commission has spent almost five years reexamining what the traditional mission of a land grant institution means today. A March 2000 report from the commission (www.nasulgc.org/) provides some guidance in this visioning for these public institutions. The report poses some of the big questions we all need to consider, such as how our traditional vision and mission fit "the times that are emerging instead of the times that have passed."

Hamel and Prahalad (1994)—writing for a for-profit audience—suggest that competitive industries need a concept that is deeper and broader than we usually envision. The authors combine key environmental forces into a concept termed "industry foresight," which is based on deep insights into the trends in technology, demographics, regulation, and lifestyles that can be harnessed to rewrite industry rules and create new competitive space (p. 76). The authors go on to suggest that leaders and institutions with effective industry foresight can "weave together a view of the future that is imaginative, compelling, and foresightful while other companies seem merely confused" (p. 81).

The characterization of foresight versus confusion can easily be applied to the higher education industry. We suggest that the concept of "competitive industries" is one that is increasingly being applied to higher education. These richer concepts of vision, mission, and industry foresight form the basis for the themes that the authors echo throughout this book. Despite the variety of topics they address and the diversity of institutions they represent, the authors in this volume bring all these concepts together with three reoccurring themes: the various organizational levels at which we can plan and create change in our institutions; the use of life-cycle planning; and the use of the power of the technology innovations to support institutional change and achieve the vision of the mission.

The higher education landscape at the beginning of the 21st century is undergoing the greatest change it has experienced in a very long time. Pressure to provide lifelong learning to students of all ages, lifestyles, and locations; a critical but sometimes subtle shift in emphasis from teaching to learning (from teacher-centered to student-centered); the demands of a technically sophisticated student population; diminishing public resources for higher education accompanied by demands for more accountability of use of those resources; industry needs for personnel with current skills; for-profit organizations invading traditional higher education spaces; and ubiquitous computing—this is our introduction to the new millennium. In 1995, Donald Norris and Michael Dolence acquainted us with the concept of transformation of higher education. They emphasized the need for us to embrace new paradigms, to think differently, to change the way we work if we are to survive. They were right! This volume asks, as *Transforming Higher Education: A Vision for Learning in the 21st Century* asked in 1995, that we leave our traditional notions of planning behind and open our minds to new ways of thinking about realizing our visions.

This volume also takes us on a journey from high-level principles of planning and change to expert practices of planning in a new technology-rich environment. As stated above, many new and emerging forces are thrusting change upon the academy. Technology is but one of them. We chose to focus on technology-driven planning for a number of reasons. Increasingly, technology plays a part in every aspect of academic life. With Moore's Law (a prediction by Gordon Moore of Intel in 1965 that the speed of microprocessor chips would increase at an exponential rate) still mapping and successfully predicting the pace of innovations, we can expect that technology will continue to evolve rapidly even as we struggle to keep up with the last generation of advances. Continuous and rapid change in technology is pressuring institutions' budgets for equipment purchase and replacement, pressuring the faculty to adopt technology-based approaches to teaching and learning, pressuring capital projects to remain flexible enough to include the latest and greatest technology in new and renovated facilities, pressuring legislatures to fund massive infrastructure and administrative application projects, and pressuring technology units to provide more support with no more resources.

The rate at which institutions are embracing the innovations made possible by technology differs between and within institutions. Some institutions are moving forward as early adopters of technology; others are more comfortable with a slower rate of change. Certainly, not everyone within an institution, even an early adopter institution, is moving at the same rate. One way of describing how institutions or groups embrace technological innovations is offered by Richard S. Rosenbloom in a 1998 report sponsored by the National Academy of Sciences (www.nap.edu/html/harness_sci_tech/ii_4.html). The three approaches Rosenbloom describes can occur either as a three-phase natural progression or as three different strategies for innovation, depending on the driving force behind the need for change. In other words, innovation at an institution may happen in many places and at various rates of change or adoption. The three approaches are as follows:

- *Imitation.* Technology is used to imitate what is already being done. Efficiency, productivity, and incremental improvements can result, such as the use of word processing of letters and papers.
- *Incremental/Integrated.* Technology is used to improve the product or process. Faculty might find that they can teach more quickly or more effectively with a lecture supported by PowerPoint slides or animations.
- *Transformational or discontinuous or disruptive innovations.* Technology is used to create new industries or new processes. In higher education, this can mean new curricula delivered in new ways, using the Web to deliver pedagogically sound, interactive learning experiences.

Institutions may, at times, gradually and progressively adopt innovative uses of technology in planning, in the curriculum, in facilities planning, or elsewhere. In other instances, transformational change can be planned and may occur without passing through imitative or incremental or integrative phases of innovation. You will see examples of both of these approaches to innovation in this book. Planning and implementing at different organizational levels provide different paths to change for institutions.

The four parts of this book funnel our thoughts from broad societal planning concepts to campuswide institutional directions to more specific planning applications in both curriculum and facilities design. The wealth of expertise represented in these chapters comes from university presidents, provosts, chief information officers, instructional designers, academic affairs officers, and facilities managers. Their institutions are large and small, two-year and four-year, public and private.

In all cases we are talking about change. After all, planning is about change—anticipating change, preparing for change, making change happen, and managing change. One way of looking at change in our institutions is to look at the life cycle of the various parts of our institutions. Life cycling is one of the major themes throughout the book, as we apply the concept of life cycling to buildings, technology, programs, and people.

Technology-Driven Life-Cycle Theme

The concept of a life cycle is relatively simple. Life cycles can describe the phases, costs, and characteristics of buildings, technologies, programs, and skills. Life cycling of technology tools often have phases such as acquisition, setup, operation, upgrade, and disposition. The operational life cycling of buildings includes maintenance, staffing requirements, and upgrading. Often, when operations or upgrade costs exceed reasonable levels, a tradeoff analysis will suggest replacement, rather than upgrading. Thus, a life cycle ends (disposition) when the item no longer possesses the qualities of usefulness that caused its acquisition.

An office building, for example, has a long life cycle. While operating costs may include refurbishing and increasing costs of maintenance, the ultimate test of usefulness is successfully passed for many years. Technology tools, however, often fail the test of usefulness long before they are old or no longer able to function. A computer with a command-line operating system (MS-DOS, for example) may lose its usefulness because better processors, more modern operating systems, graphical user interfaces, and new applications make it obsolete. Operating costs may be small, but they are not the critical variable. Rather, usefulness is the critical variable for technology.

The rate of change and the changes themselves described by Moore's Law have transformed the way we plan for a technology-intensive environment. We note that technology is supporting more and more services within the higher education environment. As this trend continues, the life-cycle concept will depend less and less on age and more and more on usefulness of the current technology and its rate of change.

Life cycling in planning used to be a straightforward mechanical/arithmetic linear process; applying life cycling in planning now requires awareness of the exponential properties of many variables. Planning, operating, and resourcing with technology have taken on complexities that were not a part of the institutional leadership mix as recently as 10 years ago.

Terms and Concepts

The authors of this volume have often traveled circuitous paths to arrive at their current thinking about technology planning and implementation. In describing their rich and often complex concepts, they use terms and concepts that may be new to the reader or that have taken on specific variants of meaning.

For example, in chapter 1, Roger Kaufman and Dale Lick are firm in their admonition that "need" should not be used as a verb; rather, for planning purposes, "need" is best used as a noun. The rationale for this seemingly insignificant distinction is profound. They believe that use of the word "need" as a verb tends to support foregone conclusions—supporting prescriptions before analysis.

Several authors refer to "system approach" or "systems approach." Each of them might be using the term with a slightly different meaning. In general, we refer to a "system approach" as one that looks at an entity in its entirety, for example, society. A "systems approach" looks at the relationship among the component parts of the system, for example, an institution.

We also introduce a concept that we term the "digital plant." While a full definition is provided in the introduction to part 3, Supporting the Vision: The Campus Digital Plant, we hope a few words here about the idea will encourage you to think about this concept throughout the volume. We refer to the physical environment of our campuses as the "physical plant." This term covers buildings, infrastructure, landscaping, utilities, mechanical systems, and more. We use the term "digital plant" to refer to all elements (hardware, software, networks, and people) of the use of information technology within our institutions. We believe that this meta-term captures the essence of the diverse and expanding technology capacity around us and gives us a badly needed vehicle for referring to the collection of related resources we refer to as "technology."

Part 1—Developing the Vision: Principles, Paradigms, Life Cycles, and Values

Part 1 includes four thoughtful contributions that set the stage for our journey. From the very first chapter, "Mega-Level Strategic Planning: Beyond Conventional Wisdom," Roger Kaufman and Dale W. Lick remind us that while our environment may be changing rapidly, the missions and core values of our institutions are stable. They challenge us to think in terms of solutions, not problems; to shift our thinking from yesterday; to set a new context; to develop new mind-sets; and to start thinking and planning strategically. They carefully lay out several levels of planning, including expected results and beneficiaries of each, to help us as we adjust our thinking.

In chapter 2, "Change Creation: The Rest of the Planning Story," Lick and Kaufman again challenge us to throw out old notions and to start thinking about what should be and how to make it happen. They describe why typical change efforts fail and define both the need and the process for creating change. They also emphasize the critical nature of learning as it relates to change and introduce the universal change principle—that learning precedes change—a concept that we hope will resonate with you. The role of culture in the change process is explored. The authors then walk us through a step-by-step change creation process, which is designed to support successful change efforts, that we hope you will try.

Chapter 3, "Academic Leadership Strategies: Partnerships for Change," provides a perspective from Gretchen M. Bataille on the need for change at our institutions. Bataille, an academic administrator with a focus on overcoming old and anticipating new paradigms, describes the changing higher education environment and directs us to the influence of technology and what she calls the "new university." The chapter outlines the efforts at Washington State University to extend its reach across the state and beyond while describing both the positive and negative results. The new relationships formed with industrial partners and professional organizations speak to the need for university responsiveness to external demands in new ways, many driven by technological change.

In the final chapter of Part 1, "Technology's Contributions to Academic Planning," J. Thomas Bowen questions the concept of technology driving academic planning and briefly reviews how technology is changing higher education. He describes technology's impact on teaching and learning, research, service and outreach, the curriculum, and institutional management and planning. In each of these areas, technology has introduced changes in the way we do business. Bowen concludes by asking us to think about technology as a driver rather than as a tool, as an enabler and catalyst for change.

Part 2—Implementing the Vision: Principles, Strategies, and Curricula

Part 2 contains four contributions—all related to technology and the curriculum. Two of the chapters take a broad look at academic planning at the institutional level and institutional readiness for technology in the curriculum. The final two chapters provide us with examples of how technology has prompted and enabled significant and broad changes in the curricula.

David G. Brown shares some guiding concepts and critical success factors that were part of the universal planning methodology that led to the adoption of a laptop initiative at Wake Forest University. In his chapter, titled "Academic Planning and Technology," he tells us about the need to make prioritized choices and encourages us with the tale of a plan in place and implemented.

Ellen-Earle Chaffee is the president of not one, but two small North Dakota state universities. Her story of the implementation of laptop initiatives and the strategic planning process that led these institutions to these specific initiatives is one of determination in the face of practically insurmountable odds. Her chapter, "The Impact of Technology on Institutional Planning," describes the success of these initiatives and the planning process that led to them.

In "Cycles in Curriculum Planning," John E. Kolb, Gary A. Gabriele, and Sharon Roy of Rensselaer Polytechnic Institute walk us through a series of six curriculum initiatives undertaken from 1988 through the 1990s. These projects included a total rethinking of their teaching and learning of computer calculus, restructuring for a standardized curriculum, and culminating in a laptop initiative. These implementations of technology provide some insight into the processes and the support that it takes to make these changes work. John T. Harwood of The Pennsylvania State University provides us with several more examples of how technology applications and tools can enable quality changes in the teaching and learning methodologies. His chapter, "Does a College Curriculum Have a Life Cycle?" and the Kolb-Gabriele-Roy chapter both address the life-cycle concept as it applies to the curriculum. They encourage us to ask curricular questions such as the following: "How often do we need to renew curricula?" "How has/can technology change the process of curricula change?" "How dynamic and responsive to outcomes should our curricula be?" In both of these accounts, current curricula were life cycled and new curricula were designed and implemented. Both these contributions provide us with an overview of the changes in planning and implementation of the curriculum prompted by technology.

Part 3–Supporting the Vision: The Campus Digital Plant

The three chapters in Part 3 address planning for technology in institutions at the service and staff development level. Two chapters describe approaches to the technology planning process as led and implemented by central IT organizations and outline the complexities of supporting a new enterprise level entity—the campus digital plant. John W. McCredie of the University of California, Berkeley has been at the forefront of change in institutional technology support over the past decades. In his contribution, "Planning for IT in Higher Education: It's Not an Oxymoron," he shares his wisdom and observations for a solid technology planning process and provides advice on what works and what doesn't. Christopher S. Peebles of Indiana University describes the Balanced Scorecard, an approach to planning, in his chapter, "Life-Cycle Costs: More Than the Cost of Hardware." He notes the massive changes in the IT organizations supporting higher education institutions. These changes have resulted in large IT organizations affecting every group and activity across campus—and requiring significant budgets. With these changes, IT organizations need tools to help their organizations become responsive and accountable. Peebles details an activity-based costing methodology to help meet these needs. He also details the specific case of e-mail services at Indiana as an application of the planning methodology.

The third chapter of Part 3, "Virginia Tech Faculty Development Institute," focuses on faculty development in the use of technology, with a description of an ongoing, seven-year, campuswide faculty support initiative. John F. Moore and J. Thomas Head describe the planning and implementation of the successful Faculty Development Institute, which is part of the Instructional Development Initiative at Virginia Polytechnic Institute and State University. Planning to achieve involvement of and support for faculty using instructional technology is the key element of this successful initiative.

We have included two planning practices in Part 3 that address specific elements of staff development and community needs. In the first practice, Martin Ringle of Reed College explores a method for overcoming IT staffing shortages, and in the second, R. Dan Walleri of Mt. Hood Community College describes a process that coordinates educational programs with local labor market hiring needs.

Part 4—Integrating the Vision: Physical and Digital Learning Environments

The three chapters in Part 4 provide nuts and bolts exposure to solid planning practices in technology-intensive facilities. Joel L. Hartman of the University of Central Florida provides practical advice on keeping technology in the loop in the facilities planning process. He shows in his chapter, "IT Considerations in Facilities Planning," that, all too often, technology is an afterthought or a victim of incomplete facilities planning. Hartman provides expert advice on how to avoid such problems.

In their chapter, "Planning for Classroom Technology," Margaret McDermott and David E. Hollowell of the University of Delaware discuss how practical considerations in the planning and design of facilities can lead to highly effective instructional spaces. They describe a case study of an enhanced planning process and offer a series of valuable lessons learned.

The final chapter is a detailed look at the varieties of technology-enabled instructional space options. Bruce M. Taggart of Portland State University offers "Developing and Supporting High-Technology Facilities," providing detailed descriptions, including graphics of seven different types of technology-enhanced instructional spaces at PSU. He provides advice on room use, assessment of the effectiveness of the use of technology, budgetary considerations, and faculty development.

We have included a planning practice by Patricia C. Williamson of the Houston Community College System and another by Patricia Seller-Wolff and Mark Wells, formerly of Rice University. Each planning practice describes the use of specialized technology for effective institutional management.

Summary

We have organized this book as a thought-provoking progression from high-level planning principles to specific case studies. We've been challenged to drop our paradigms of the past, to change our mind-sets, and to think in new ways and broad terms about planning. What is, or should be, the value of higher education to society? How do we create change rather than merely react to the changing environment around us?

We must consider that technology may be a driver, but it is also more than that. Technology tools and applications are changing our society, our environments, and all our interactions. Planning—not just responding to how these tools can best support our mission in society—is a major planning challenge. The changes in curricula and the laptop or computer ownership requirements for students are ways of assuring that we use the technologies at our disposal to improve the quality of the academic experience of our students. To accomplish our "vision," we must plan appropriately, think broadly, and invest wisely.

We hope that the chapters that follow will provide you with powerful information to help you realize *your* vision.

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Part 1

Developing the Vision: Principles, Paradigms, Life Cycles, and Values

Most academic leaders are now talking with increased understanding about the need to plan for the life cycling of rapidly changing and evolving technology on campuses. And as we all become more accepting of the total integration of technology into daily communication and information processes, it is becoming readily apparent that the concept of life cycling is fundamental to the planning of all institutional components.

We have always understood the value of the concept of the life cycling of physical buildings; we must now implement similar planning, designing, budgeting, and life cycling for the rest of our environment—the digital layers and components of our infrastructure. We must plan for the life cycling of our teaching and learning resources, the evolution of the types of spaces that support students, our faculty and staff development needs, and the products that constitute our missions—our curricula, research, and service. Since changes in the technologies are now occurring so rapidly, it is more important to bring to the fore the core values and principles of our institutions. It is those core values that will guide what we do within each life cycle of tools and staffing.

Planning and implementing this new life cycling of our institutions requires more learning and more attention to consensus than we have had in the past. A shared mind-set, a shared vision, of the institution and its mission is needed. Why is this shared mind-set more essential now than in the past? There are two reasons. First, all the components of our institutions are more interdependent and interrelated than ever before. We do not network individual buildings; we network the entire campus. We do not develop a student services module for one college; we plan for the services of all students across every college and every type of program. Second, the world outside the campus is so different from what it was only a decade ago. The institution is one part of the greater whole. It always has been, but the impact of technology innovation and adoption has been longer, more comprehensive, and more disruptive than previous technology innovation cycles. Also, many of the early computing technologies were developed on campuses that gave universities an advantage in their use and a lesser sense of urgency in their application. Today, the changes are pushing at the campus boundaries. Product cycles, the speed at which products and services are designed and delivered, are dramatically shorter. This pace of change that we are experiencing is often called "net time," referring to the impact of the Internet on dramatically faster changes in products and services and companies. The shortened product and service cycle in industry should be mirrored on our campuses.

We know that we need to plan. What is not as clear now is what we are planning for, particularly in the face of the demands of the constituencies. In chapter 9, John W. McCredie argues that we must not fall victim to thinking that change is so rapid that we cannot plan effectively. Rather, we must plan based on direction and principle, not specifics.

The chapters in Part 1 have been designed to aid in the development of a shared mind-set, a shared vision that will guide the change and the planning. These authors provide significant basic ideas and principles that can help to lay the foundation of this shared mind-set. Doing this will take time, and it is an institutional task, not a small group or individual task. Leaders from across an institution will require a great deal of collaborative learning and work. Planning for the development of the shared mind-set in the institutional leaders is the first step. The second step is to develop a shared vision of the future of higher education within this group, answering questions such as "What will the future of higher education be?" The third step is to develop the shared mind-set, the shared vision for the institution within the larger landscape of higher education. This step answers the question "What do we see as the future for our institution?"

It will be easy to slip into the mode of "business as usual." However, more than that is highly recommended. In their book *Competing for the Future*, Gary Hamel and C. K. Prahalad (1994), pose three questions that industry leaders who are interested in developing an effective vision for their industry should consider:

> 1. What types of customer benefits should we seek to provide in five, ten or fifteen years?
>
> 2. What new competencies will we need to build or acquire to offer those benefits to our customers?
>
> 3. How will we need to reconfigure the customer interface over the next several years? (p.73)

As we apply this thinking to our higher education institutions and missions, these questions may seem foreign until we translate/adapt them to the following questions:

1. What types of student curricula and student offerings should we seek to provide in five, 10, or 15 years? And what types of packaging in terms of time, cost and skills, and knowledge will make these educational experiences attractive and useful to students?
2. What new competencies—in our staff, faculty, and systems—will we need to build or acquire to offer those benefits to our students and to our constituencies?
3. How will we need to reconfigure our systems and programs for our daily interface transactions with our students, faculty, staff, and community and society over the next several years?

Answering these questions will occur over time; seriously thinking about these now will aid in the development of a shared vision of what we are planning for.

In the introduction, we set the overall framework for the chapters in this book. By considering the way technological innovation is approached and adopted, we suggest that change may be incremental or transformational, but change will occur. With a strong, shared vision, our institutions will be far better prepared to answer these critical questions and to plan for the change that technology is thrusting upon us.

Part 1 begins with two chapters by Roger Kaufman and Dale W. Lick of Florida State University that lead us from a perspective much greater than our individual institutions, mega-level strategic planning, through a process termed "change creation." Part 1 then continues with a chapter by Gretchen M. Bataille of the North Carolina System on the level of thinking about the higher education landscape at an institution and system. In terms of the technology innovation cycle, this chapter focuses on a vision of what the transformational service might provide. The last chapter in Part 1, by J. Thomas Bowen of The University of Georgia, brings us close to where we are today, the realities of what many campuses are struggling with. It describes some of the current realities of the integrated, incremental processes now consuming our attention—dealing with the alligators! As a whole, Part 1 helps us develop a new way of thinking and a new perspective for developing a shared vision for higher education and supporting effective institutional planning within the emerging, expanding, and competitive higher education enterprise.

Chapter 1, titled "Mega-Level Strategic Planning: Beyond Conventional Wisdom," invites us, draws us, pulls us out of the confined boundaries of our campuses. We like to see this chapter as providing the rocket thrust that enables us to look at our campuses as we were first able to look at our planet from space. A new sense of purpose and of relationships is an almost immediate result. The process of mega-level strategic planning described in this chapter is not for the faint of heart. Authors Kaufman and Lick ask incisive, almost troubling questions. Do we have a vision not just for our campus, but for our current and future society? What is the value that society derives from our educational enterprises? And if society is the "primary client and beneficiary" of educational enterprises, do our institutions plan and implement with this societal value mind-set?

Kaufman and Lick describe three levels of planning to complement the development of a strategic vision: the mega or societal level, the macro or institutional (or organizational) level, and the micro or organizational component (group level) of planning. It is the mega or societal level of planning that is the starting point at which we ask ourselves questions such as "What outcomes does society need and want from our institutions?"

Mega-level strategic planning is a concept that takes us beyond ourselves, beyond our institutions, and beyond our world. One of the constant and unchanging expectations of higher education is that we build and develop leaders to guide the next generations of society. They must have a vision of what that society can do on a local basis. Now in the 21st century, we are called to think, plan, and vision globally and nationally, but design, plan, and implement locally.

What do higher education institutions have that can support the evolution of a just society? We are tasked with the creation of knowledge, the storage of knowledge, the accessibility of knowledge, and the acquisition of knowledge for guiding the development of society. In many respects, higher education is viewed as the core of the knowledge society that Bataille addresses in chapter 3. What can we do to be responsive to these needs of society and to support the development of individuals who are competent in the knowledge society, but who also demonstrate the greatness of wisdom and justice to help create the society that we want our children to be a part of?

This mega-level planning may seem somewhat distant from our tripartite mission of research, teaching, and public service. But when linked with the requests for improved productivity, reductions in cost, and greater efficiency in our institutions, it is not. If this is not what we are about, what is it?

The message to do mega-level strategic planning leads us directly to the messages in the companion chapter by Lick and Kaufman, "Change Creation: The Rest of the Planning Story." In this chapter the authors describe change creation, a process that includes mega-level strategic planning and the principles and a process for managing the change that is desired from the planning process. We wrote earlier about a shared mindset and vision. One outcome of strategic planning is a vision of what we want to plan, to achieve, and to be. Change creation guides the process by which the vision plan is developed and communicated and the steps by which a change process is implemented.

Chapter 2 describes a universal change principle that is fundamental to the change creation process. That principle is that learning precedes change, a simple and very powerful concept. Belief in this principle affects how visions are communicated to whom, when, and with what level of sponsorship a change is promoted. This principle also informs why so many change initiatives fail and holds the key to what must be done to support effective change.

Another key principle in the change creation process is a clarification of the various roles that institutional leaders must play in any change process. Chapter 2 describes four key roles in the change process: change sponsorship, change agent, change target, and change advocate. The concept and role of sponsorship is the one most likely to be lacking in most change processes. Lick and Kaufman summarize the many benefits that a change sponsor brings to a change, and we learn that a missing, ineffective, or weak sponsor is a key reason for the failure or dissipation of change efforts.

The last part of this chapter provides an 11-step guide for the entire process of change creation. This section can provide the basis for effective change planning and implementation.

Chapter 3, "Academic Leadership Strategies: Partnerships for Change," focuses on the institutional level and how technology innovations are affecting planning and programs at the campus level. Author Bataille is clearly focusing on how and in which areas of service information technology is driving a fresh examination of the mission of the institutions. In the technology adoption and innovation spectrum, she looks at how technology is disrupting and transforming current practices and services.

Bataille speaks directly to academic leaders about a new focus of higher education institutions relating to two key constituencies, students and industry. She describes the Extended Degree Program (EDP), which meets the needs of place-bound returning adult students while also meeting the needs of students who are on campus but benefiting from the flexibility of time and place offered by the EDP. Bataille also describes some of the partnerships with industry launched while she was at Washington State University. These partnerships are enabling and encouraging the development of faster and more flexible models of curriculum development.

In Bataille's vision, these initiatives exemplify the shifting of our current model of complex and shared governance to a new model that is characterized by partnerships, pilots, and more flexible packaging of instructional products. These initiatives also support a vision of the "new university" as one that is network-based rather than geographically based.

This transformational vision at the institutional level is grounded in the core mission and responsibility of a university. Bataille states that part of the value of the university to society is that "[w]hat the university does is to transform information to knowledge and learning," with the result that the "degree to which universities embrace technology and use it to transform information will be the measure of success for the university of the future." Thus, a key message is that technology is a catalyst for the transformation of higher education so that we can be responsive to and support society. And then Bataille brings us full circle to the societal vision by stating that a "learning society requires that we ensure education to everyone throughout his or her life or the society will not be a just society."

But where are we today? Are we close to using technology to transform our educational services—to planning with technology for the transformational and disruptive nature of current trends? Bataille gives us some excellent glimpses into new partnerships. But what about the reality of where many campuses are today?

The last chapter in Part 1 brings us down to earth. In chapter 4, "Technology's Contributions to Academic Planning," Bowen provides a comprehensive look at how technology is affecting our institutional services and models. He clearly describes the impact that technology is having while subscribing to the goal of integrating technology into our campuses. It is now very apparent that as communication, research, teaching, and learning tools, the new information technology tools are unrivaled. These tools change every facet of teaching, learning, and administration. A major factor in the change process is the change that is occurring just outside our campuses. Every sector of life is changing based on the transformational power of the tools.

Moving directly to a transformational state of implementation, however, is not always recommended. Too much change or poorly planned change is just as negative as insufficient change. Bowen reminds us of the impact of change that occurred in 1825 when Harvard University instituted an elective system. The choices being enabled by the new rush of technology appliances will have unforeseen effects in the very near term. So we need to consider the impact of these choices in five, 10, and 15 years. And then, of course, we can use the visioning and change creation tools to achieve our missions. The products of our mission are needed more than ever to support the needs of lifelong learners.

These four authors can help us develop a new way of thinking, a new view of our higher education enterprise. From a global societal perspective, we then come down to earth to the everyday challenges that many campuses are struggling with today. Bataille states that "[k]nowledge and learning have become the core of a competitive industry." How do we create and adopt the industry foresight that will guide us to a society-friendly transformational vision of this new world of higher education?

Roger Kaufman and Dale W. Lick

1

Mega-Level Strategic Planning: Beyond Conventional Wisdom

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This chapter introduces and discusses a new strategic planning approach for higher education: mega-level planning, which importantly focuses on society as the primary client and beneficiary. It suggests and provides the supporting rationale for why success in education is best achieved by linking everything an educational agency uses, does, produces, and delivers to adding value to society and to internal and external partners.

The chapter begins with a discussion of the measurable value education adds to society and of shifts from yesterday's paradigms. It then provides a series of new perspectives and mind-sets and a new context for mega-level strategic planning. With this foundation established, the chapter unfolds and illustrates key elements of strategic thinking and planning and the future-oriented mega-level strategic planning process.

Solutions Versus Problems

If education is the solution, what is the problem? What value do educators add to society, our learners, our associates, and fellow citizens? What is their purpose? In its minimal terms, the purpose of education is simple and clear: provide useful learning opportunities that will result in learners being successful in school and life. An indicator of this success is the extent to which the learners served are self-sufficient, self-reliant, and add value for their families, associates, employers, communities, and our shared world.

Such a basic and simple intent is rarely formally considered, defined, and used when education is designed, developed, delivered, improved, and managed. Instead, we tend to focus on pieces and parts of our educational enterprise—our faculty, learners, facilities, equipment, funding, curriculum, courses, activities, delivery modes, unions, research, and administration. The key results and contributions—such as effective leaders who make real contributions and societal contributions—are often missed. Also, the vital element required to be effective leaders is often missed—a focus on societal value and contributions to internal and external stakeholders.

For the future, what could happen if leaders and educators defined and delivered successful educational systems? How can our educational institutions be more like learning organizations (Garratt 1994; Senge 1990) that learn from their successes and failures, and proactively and progressively improve?

The Important Shift From Yesterday

Yesterday has passed; let it go. What made things successful in the past will likely get educators into trouble in the future (Marshall and Tucker 1993; Kaufman, Herman, and Watters 1996; Kaufman 1998, 2000). The world has changed dramatically and so have expectations and the required planning focus for higher education. For many, this is not a comfortable thought. It means that the same strategies, tactics, and tools that made educators successful in the past may now fail them.

The old planning paradigm, still taught in colleges of education and public administration, focuses on resources, methods, delivery, courses offered, and degrees granted, and rarely looks at the aggregate cost consequences of these. Thus, the basic matrix for adding value to external clients and society is either assumed or ignored. The paradigm for defining and delivering educational success has shifted, and shifts require changes in how to do strategic thinking and planning in the future. Specifically, continuing to dwell in present comfort zones tends to lock educators and institutions into yesterday and lessens the future potential for higher education and learners, educators, citizens, and society.

Politics, as the art of the possible, comes into play when there is a logic and rational vacuum.

Further, shifting from old perspectives often flies in the face of the demands of political forces—elected and other—who are the products of our past: citizens of tomorrow who were educated yesterday supposedly to be stewards of positive change, not blockers of it. When politics comes into play, educators are frequently harvesting previous plantings. Politics, as the art of the possible, comes into play when there is a logic and rational vacuum, and then "agreement of people" often becomes more important than "usefulness of results." In such situations, old mind-sets may get educators into trouble, even while making them feel comfortable.

Demands on higher education are increasing. Not only must educators deal with more learners in less time and with relatively fewer dollars, they are increasingly called on to prove that they offer added value for the money invested—more accountability for results, increased demand to speed up the processes of education, greater expectations for doing more with less, and the ability to prove it all (e.g., the Government Performance and Results Act of 1993 now requires that value added be demonstrated based on each agency's strategic plans). For instance, competition is upon us with distance/distributed learning programs fostering new operations within and outside traditional universities—all offering more for less and at a greater convenience. Consequently, adding value becomes increasingly important. Value added means the increase in value and worth over and above current results and resources being expended. It should be considered for both internal educational return on investment (value of results as compared to costs involved) as well as external return (what value has been added to society).

The usual focus for what is called "strategic planning" is, typically, on internal organizational operations, curriculum content, and delivery concerns. For example, it focuses on the good of the organization; is reactive; and usually projects the current educational mission, goals, and activities forward in time (Kaufman 1992, 1998, 2000; Kaufman, Herman, and Watters 1996). In addition, there is a concern with and selection of means (e.g., resources, methods, activities, programs, courses, and curriculum) before deciding and validating ends (e.g., results, consequences, and societal value added) in terms of contributions education makes to learners, stakeholders, and communities. For higher education, value added could be societal contributions of graduates over and above costs to educate them. Again, old paradigm thinking would assert that indicators could not be obtained for such. To the contrary, and more and more in the future, it will have to be proven that what is invested in education is not better spent elsewhere. Showing this return on investment, while perhaps initially foreign to educators, is a pragmatic step in ensuring that higher education institutions will not be replaced by other societal ventures.

Setting a New Context

Educators are preparing citizens of tomorrow who will be responsible for making their shared, dramatically changing world better, measurably better. As part of strategic planning and moving toward such goals, outlined below are key perspectives that should help to begin to shape a new realistic, pragmatic, practical, and useful planning model—based on new realities of our ever-changing world—for educational leaders and planners.

Many educational leaders and planners experience discomfort with these new perspectives. However, regardless of how one feels, such perspectives give a sense of and begin to set a valuable contextual foundation for both "what is" and "what will be" in the current and future world.

- Since you can't predict the future, create it (Drucker 1973).
- Doing societal good is no longer an organizational option—it is a "must" (Popcorn 1991).
- Change must benefit all partners, internal and external (Kaufman 2000).
- The overarching approach is to think globally and act locally. (This has served sensible environmentalists well for many years.)
- Educators can be masters of change or victims of it (Conner 1993; Kaufman 1972).
- Reality is not divided into disciplines, departments, courses, programs, curricula, agencies, laws, policies, and issues (Kaufman 1998).
- Today's problems can't be solved with the same paradigms and tools that created them (Marshall and Tucker 1992).
- If it ain't broke, fix it . . . or better, blow it up and invent new (Peters 1997).
- Today's capitalism is not one of money and things but of knowledge and information (Drucker 1993). This shifts the world—and what educators do and contribute—from a zero-sum game to a win-win game. It argues persuasively for cooperative efforts on the basis of shared positive societal contributions.
- Educators are now getting better and better at doing that which should not be done at all (based on Drucker 1973).
- Good ideas can fail for the wrong reasons.
- Everyone is entitled to his or her own opinion but not to his or her own data.
- The focus of consideration is sharpened when educators ask, "If your organization or approach is the solution, what's the problem?" (Kaufman 1998, 2000).

New Mind-Sets for Planning

The new perspectives discussed above provide helpful mind-sets for successfully dealing with several areas fundamental to strategic planning including educational leadership, change, planning, and continuous improvement.

Educational leadership.

- Be responsible for what is done as well as for the consequences of what is delivered. Results and value added are the "coin of the professional realm." If educators, or anyone else, do not deliver useful results (and prove it), they have an ethics problem.
- Use President Harry S. Truman's model, and act as if you will read about what you did and accomplished in tomorrow's newspaper.
- Consider people's impressions and observations, but substantiate them with hard performance data. If the two don't agree, collect more data. Planners must use both "hard" performance data, which can be externally validated, and "soft" data, e.g., personal individual perceptions (Kaufman 2000; Kaufman, Herman, and Watters 1996).
- Don't do anything just for money or simply to please someone else. What is right is right. You are what you do and deliver. Remember, usefulness must take priority over comfort. Treat people as a vital part of the system. Build their trust, confidence, and participation and celebrate their commitment, abilities, and effective performance, especially as these relate to adding value inside and outside the institution.

Change.

- Appreciate that change is painful for most people. Make certain that the change you are facilitating is imperative (i.e., will add significant positive value) and that you are providing the necessary "learning" to help others understand the change, its value to the institution, and its implications for them.
- Don't treat change as only being incremental. It often happens in leaps when a paradigm shifts. Don't crawl when you must jump, and don't jump simply because others are doing so. Get the data, use your intuition (Barker 1989), and make the right and courageous decisions.
- Be proactive. If you wait for things to happen, you will always be trying to catch up. Define the world you want to help create for tomorrow and move boldly toward it.
- Understand that resistance to change is usually based on fear, including fear of the personal implications

of the change, fear of how to do it, fear of failure, and fear of finding out something you don't really want to know. Fear and resistance are natural and normal; therefore, when considering evaluation information, never use it for blaming.

- *Take the time necessary, as you prepare for a major change,* to overtly plan for the transition of the people, processes, and circumstances from the old to the new.
- Keep in mind that people are "control beings" (Conner 1993). This means that the more they understand, accept, and have a sense of control, the more comfortable they are with the change and the greater the likelihood that they will genuinely commit to helping the change become a reality.

Planning.

- Accept that hope is not the same as reality. For example, teaching is not the same as learning, and learning does not necessarily result in useful performance.
- Don't confuse means and ends. Means are only useful to the extent to which they deliver worthwhile ends. Focus on ends (results) before selecting means and resources.
- Don't confuse needs (gaps in results) and wants (preferred means and ways and tools for meeting needs). Define needs as gaps in results, not as deficiencies in resources or methods. Prioritize needs on the basis of the cost to meet them as compared to the cost to ignore them.
- Take note: "needs assessment" and "needs analysis" are not the same, and both are essential to effective planning. Also, note that "system approach," "systems approach," "systematic approach," and "systemic approach" are, though important in planning, different (Kaufman and Watkins 2000). A "system approach" primarily focuses on society, while a "systems approach" focuses on parts within an organization. And one can be systematic—orderly—without being correct or useful.Likewise, "systemic" affects a total organization but still might not add value to external stakeholders.
- Don't start performance improvement at the individual level or without linking performance to internal and external performance contributions. If you do, you will be wrong 80–90 percent of the time (Triner, Greenberry, and Watkins 1996). While it is more comfortable and conventional to start at the individual performance level (e.g., with a "training needs assessment"), it will be misleading most *(80–90 percent) of the time.*
- Direct your efforts to three levels of planning (mega, macro, and micro) and measures of their associated levels of results (outcomes, outputs, and products). Mega-level planning focuses on society as the primary client and beneficiary—societal value added. The primary client and beneficiary for macrolevel planning is the organization itself, whereas for microlevel planning, individuals and small groups are the primary clients and beneficiaries. All three are vital and must be linked. Note that mega, macro, and micro are not code for big, smaller, and smallest.

Continuous improvement.

- Consider what you use, do, produce, and deliver. If these don't add value for internal and external clients, don't do them.
- Improve continuously. You cannot make rational and justifiable decisions without good, valid, and reliable performance data. Use such performance data for fixing but never for blaming.
- Link everything you deliver to the value it will add within and outside the institution. Performance improvement is not a vacuum within an organization, nor it is free from interaction effects with other performance contributions. Performance change should be based on needs—gaps in results—and in system fashion: change in any one area affects all other areas (Rummler and Brache 1990). An organization must be seen as a mission-driven system, not isolated subsystems (regardless of the labels we use) that we work on individually with the profound hope that everything will come together well.
- Learn from both successes and failures, and fix what requires correction and continue what is working well. Learn from what has gone on before and act on performance. You might have some additional items to add to these new mind-sets—"rules of the road" for defining and achieving success. However, the important thing is that you deal in results and add value inside and outside the organization and

to society. If you don't have that in mind, what do you intend to do to prove that you are a professional?

Strategic Thinking and Planning

The song "It Ain't Necessarily So" from *Porgy and Bess* often describes what happens during planning. In planning, what gets called "strategic" is not necessarily strategic. What gets called "strategic planning" in education is usually tactical or operational planning. *Strategic planning* identifies and justifies new destinations as well as notes changes to past purposes; that is, where an organization is headed in terms of adding value to society and why it should get there. *Tactical planning* (which is too frequently labeled strategic planning) identifies possible ways and means—tactics and tools—for getting from current results and consequences to those identified in the strategic plan; that is, best ways and means to get from current results to desired ones. *Strategic thinking* is the way in which everyone in an organization focuses first on value added for external clients and society and then (and only then) defines what the organization should deliver, produce, do, and use.

Strategic thinking and planning define where you should be headed. As Mager (1997) noted, "If you don't know where you are headed, you are likely to end up someplace else." It is imperative that destinations are defined in rigorous, measurable, and precise terms. Direction setting and direction justifying are primary functions of useful strategic planning.

One confusion in the culture is between "ends" and "means." Ends are results, consequences, impact, and payoffs, and means are activities, processes, programs, projects, teaching, service, and research. Both are important. But means must be related to desired ends; otherwise, one doesn't know what to do or how to do it. Ends define purpose; means define how to achieve purpose. It is often a matter of blind faith and hope that "good means" will deliver useful ends—a risky assumption at best!

Basic to effective planning and beyond conventional wisdom is the use of external society value added as a primary determinant of what an organization's mission should be. Inclusion of societal value added allows for the creation of a meaningful and compelling societal framework, an ideal vision, for strategic planning. For example, a brief statement of an ideal vision that should drive all organizational purposes—educational as well—might be: "The world we want to create for tomorrow's child" (Kaufman 1998, 2000; Kaufman, Herman, and Watters 1996). The following example is a more *extensive illustrative statement of an ideal vision,* based on the perceptions of people almost worldwide who were asked to define the kind of world they would want to help create for tomorrow's child. The successful application of mega-level strategic planning toward an ideal vision is based on the reality that it might not be achieved in a specific time frame, but the effort dignifies the requirement to make continuous progress toward the ideal and revise if and when things stray.

Be proactive. If you wait for things to happen, you will always be trying to catch up.

An Ideal Vision

The world we want to help create for tomorrow's child.

There will be no losses of life nor elimination or reduction of levels of well-being, survival, self-sufficiency, quality of life, from any source including (but not limited to): war and/or riot; unintended human-caused changes to the environment, including permanent destruction of the environment and/or rendering it nonrenewable; murder, rape, or crimes of violence, robbery, or destruction to property; substance abuse, disease, pollution, starvation, and/or malnutrition; destructive behavior (including child, partner, spouse, self, elder, others); accidents, including transportation, home, and business/workplace; and discrimination based on irrelevant variables, including color, race, age, creed, gender, religion, wealth, national origin, or location. Poverty will not exist, and every woman and man will earn at least as much as it costs them to live unless they are progressing toward being self-sufficient and self-reliant. No adult will be under the care, custody, or control of another person, agency, or substance: all adult citizens will be self-suf-

Type of Planning	Related Name of Result	Primary Client and Beneficiary
Megaplanning	Outcome	Society and community
Macroplanning	Output	The organization itself
Microplanning	Product	Individuals and small groups

Table 1.1 Types of Planning, Associated Results, and Primary Clients and Beneficiaries (based on Kaufman 1998, 2000)

> ficient and self-reliant as minimally indicated by their consumption being equal to or less than their production. (Kaufman 1998, 2000; Kaufman, Herman, and Watters 1996)

Levels of Planning and Results

Strategic thinking and planning starts with an ideal vision[1] (as stated previously) that states, in measurable terms, where educators are headed and how to tell when they have arrived (Mager 1997; Kaufman 1972, 1998, 2000). Coupled with the ideal vision are three levels of planning (mega, macro, and micro) and three levels of associated results (outcomes, outputs, and products). This approach to planning and focus is termed "megaplanning." In megaplanning, the primary client and beneficiary is society and community, not the organization itself. Results at the mega-level are called outcomes. Thus, any educational organization is actually a means to societal ends.

The second level of planning is macroplanning, and its primary client and beneficiary is the organization itself. The organization, through macroplanning, determines what its mission objective is to be. A mission objective states where the organization is headed and how to measure when the organization has reached its objective. An organization's mission objective states, in precise terms, what part or parts of the ideal vision it commits to deliver and move ever closer toward. Results at the mission objective level are called outputs.

The third level of planning is called "microplanning." Based on the mission objective (macrolevel plans), an organization, through microplanning, then "rolls down" from that to define what building-block results it should deliver. This level of planning usually depends on individuals and small groups to develop and deliver these important results called products. Table 1.1 summarizes the three levels and their associated results and primary clients and beneficiaries.

In the literature, unfortunately, these levels of results are usually blurred with most results being called "outcomes." Doing so blurs the identification and understanding of outcomes, outputs, and products, and the responsibility for their linkages, as shown in the upper three levels of figure 1.1. It is self-defeating to develop and deliver products that don't add value to outputs and outcomes.

From the ideal vision, the most productive place to start planning is at the mega-level and then roll down to define the other two levels of results. This forms a results chain. Then, based on the results, the data exist to sensibly define (and justify) means—activities, programs, projects, courses, curriculum, methods, and media. Then, you can usefully define the inputs—the resources such as staff, materials, buildings, facilities, policies, and laws—to get the desired and required results. This full chain of results and means is shown in figure 1.1.

Mega/Outcomes
↑↓
Macro/Outputs
↑↓
Micro/Products
↑↓
Processes
↑↓
Inputs

Figure 1.1 Organizational Elements and Their Interrelationships (based on Kaufman 1998, 2000)

Organizational Elements Model

The five elements discussed previously—mega, macro, micro, processes, and inputs—identify what every organization uses (inputs), does (processes), produces (products), delivers outside the organization (outputs), and adds to societal value and its impact (outcomes).

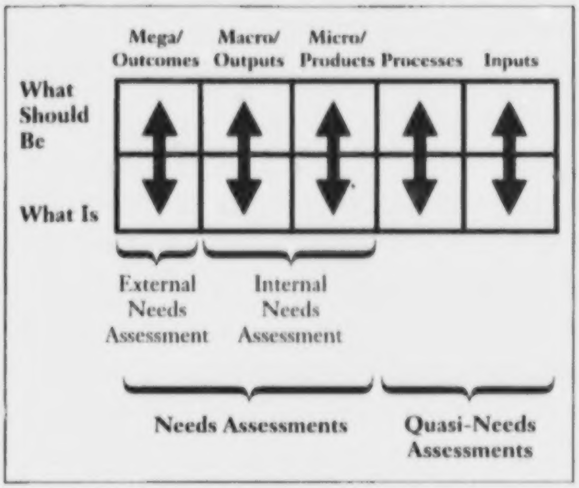

Figure 1.2 Five Organizational Elements, Their Relationship to the Two Dimensions of What Should Be and What Is, and Three Types of Needs Assessments (based on Kaufman 1998, 2000)

Using these elements, the organizational elements model (OEM) can be arrayed on two levels: "what should be" and "what is," as shown in figure 1.2.

The organizational elements in figure 1.2 show a "stacking" on two levels of focus: "what should be" and "what is." Three of the organizational elements deal with ends (or results). And, as will be seen shortly, the two levels of "what should be" and "what is" for results help an organization define *needs*—gaps in results, not in inputs or processes. Planning may move forward from these discrepancies (gaps) between "what should be" and "what is" in terms of results.

Needs Assessment Definition

We tend to jump into means—resources, methods, tools, and activities—without first defining the gaps between current results and consequences and required ones. To avoid this leap from unwarranted assumptions to forgone conclusions, such as "we need smaller classes" and "we need to have more funds," it is important not to use "need" as a verb. When "need" is used as a verb, it restricts options. In particular, "need" is a very demanding word, and when it is used in a verb sense, it takes away choices and options simply because people are attempting to prescribe—prescribe solutions before defining the problems. For example, politicians use "need" as a verb constantly, and it is an attempt to push a solution before the problems and real needs (gaps in results and their consequences) have been identified and validated (Kaufman 1972, 1998, 2000; Kaufman, Herman, and Watters 1996).

Vital to any useful planning, including strategic planning, is an understanding that needs are gaps in results and not gaps in means, resources, methods, or activities. A need is a gap between current and desired results. The process for deriving the basis for valid and useful objectives, at the mega-, macro-, and microlevels of planning, is called needs assessment. Needs assessment is the identification of needs and placement of them in priority order on the basis of costs to meet needs versus costs to ignore them.

As noted in the previous figures, there are three types of needs and thus three types of needs assessments for mega/outcomes, macro/outputs, and micro/products levels. Because megaplanning focuses on external clients and society, needs assessment for that level is an "external needs assessment." By contrast, the harvesting and prioritizing of needs for the macro- and microlevels of planning are "internal needs assessments."

Defining "need" as a noun is one of several critical success factors for useful strategic planning and thinking. Critical success factors guide strategic thinking and planning to ensure that whatever is used, done, produced, and delivered will add measurable value to external clients and society. We have found six critical success factors, which include the following:

- Use new and wider boundaries for thinking, planning, doing, and evaluating/continuously improving—move out of today's comfort zones.
- Differentiate between ends and means (focus on what before how).
- Prepare objectives—including ideal vision and mission objectives—that have measures of how you will know when you have arrived (mission statement plus success criteria).
- Use all three levels of planning and results (mega/outcomes, macro/outputs, and micro/products).
- Use an ideal vision as the underlying basis for planning (don't be limited to your organization).
- Define "need" as a gap in results (not as insufficient levels of resources, means, or methods) (Kaufman 1998, 2000).

All critical success factors should be employed if successful strategic planning is to be initiated and developed. Each one focuses efforts and results on external societal value added.

Mega-Level Strategic Planning in Action

The following example shows how this approach can be applied in higher education. It is based on an actual project initiated at Florida State University (Kaufman 1995, 1998).

The then-president of Florida State chartered a task force of faculty and stakeholders to determine the feasibility of distance learning for the university. Instead of starting with the solution, distance learning, the committee decided to do megaplanning. In so doing, it asked and answered two basic questions:

- If Florida State University is the solution, what is the problem?
- If distance learning is the solution, what is the problem?

This was an "outside-in" approach that did not assume that the university or distance learning should exist without proving that either or both could add value to learners, faculty, staff, and the community. So, in answering the first question, "If Florida State University (or any institution of higher learning) is the solution, what is the problem?" the following mission objective was derived. Note that it builds on an ideal vision similar to the one in the earlier section on strategic thinking and planning.

A University Mission Objective

By the year 2020, all who graduate from our system will enroll in accredited graduate higher educational programs and/or get jobs in their first, second, or third professional or career choice. In addition, they will choose and continue their formal and/or informal education and training. All graduates will be responsive and responsible citizens who are not under the care, custody, or control of other persons, agencies, or substances. They will volunteer in civic activities. They will have come through a university that has served them so that they compare favorably on valid and reliable criterion and/or norm referenced assessments for their general and specific knowledge and abilities. Their education will take place in a drug-free, crime-free, and supportive environment. All who seek it will have universal access to appropriate information and knowledge with validated learning opportunities geared to each learner's diverse characteristics, abilities, and potential. Learners will leave realizing that their higher educational experiences readied them for life, work, and the future. The foundation for the knowledge, skills, abilities, and attitudes they acquire will be based on research conducted, completed, and published in refereed journals (or jury acceptance for the performing and literary arts), and the university will be rated in the top 20 higher education institutions in the United States. The top research ranking will be substantiated by its being among the top 20 universities in the United States in terms of external contract and grant funding in the areas within which it offers graduate and undergraduate programs. In addition, at least 10 percent of a faculty in each academic department will be honored by earning at least one of the following indicators of distinction: president or past president of a national/international professional society; awarded Fellow status in their academic/professional society; a member of the National Academy of Sciences or equivalent; editor of a professional journal; published one or more textbooks considered as in the top five quoted texts in their field; exhibited in a national juried show; awarded a national award for a performance, poem, book, or art product; or other comparable demonstrations of contributions. The learners will show no differences in graduation rates, job placements, economic success, employer satisfaction, or dropouts on the basis of irrelevant variables including location, color, race, creed, sex, sexual orientation, religion, or national origin.

An example of an associated mission objective for distance learning, generated by rolling down from an ideal vision to an organization's mission objective and then to a specific program, project, or initiative, follows:

> **A Mission Objective for Distance Learning**
>
> By the year 2010, every Floridian will have full access to valid, individually responsive, and useful learning opportunities, including information, delivered in an appropriate as well as convenient place and time, usually remote from the delivering source, by the most effective and efficient means that current pedagogies and technologies allow. The learning opportunities they receive will assist (add value to) them to continuously function as knowledgeable individuals and effective citizens. The content of the learning opportunities will be for both degree and nondegree seeking Floridians (including professional and personal development as well as skills/competence certification). The learning opportunities will provide them with the skills, knowledge, attitudes, and abilities to (a) continuously improve their self-sufficiency, self-reliance, and quality of life; (b) increasingly become responsive and responsible workers and citizens who are not under the care, custody, or control of another person, agency, or substance; and (c) allow each individual to make contributions, both in the workplace as well as in their lives, and to Florida as it moves progressively toward the shared ideal vision and mission objective of the university(ies). Each learning experience will have been designed, developed, and certified as having valid content and will appear to be cost-effective and cost-efficient in the achievement of performance objectives. The delivery of learning opportunities will be through channels of communication selected on the basis of a cost/results analysis and will provide positive return on investments in terms of payoffs for both Florida and distance learners. The source of the distance learning experience will be from any origin that provides validated learning materials, and the learning experiences will be made available without concern for the agency making it available. The mastery of content, graduation, and completion rates of course/program/certificate programs and activities, and the satisfaction rates for learners using distance learning options will be at least as successful as those of the cohorts completing their studies on campuses. The progress of learners will demonstrate contribution to the institution's mission objective and meet all certification, accrediting, and professional requirements.

Direction setting and direction justifying are primary functions of useful strategic planning.

It is interesting to note that many, if not most, distance learning programs have quickly focused on the delivery of courses—and quick cash flow—without first having identified needs of learners, educators, and society. Most distance learning is the presentation of Web-based, computer-based, or television-based old content and assumes that what is being provided is valid, validated, and useful. It is suggested that the next generation of distance learning will use a megaplanning approach if it intends to add value and be able to prove it has done so.

Summary of Strategic Thinking and Planning

Strategic thinking is used to align what educators use, do, produce, and deliver to give added value for external clients and society. Strategic planning is the process that begins with an ideal vision—a measurable statement of the kind of world we want to help create for tomorrow—and then defines the organization's mission objective. With this strategic alignment of mission with societal vision (ideal vision), reasonable and justifiable determination of building-block results, related methods, and resources can be selected.

Strategic alignment best comes from the OEM by rolling down from the mega-level to macroplanning to microplanning to processes to inputs. From this progression, it is more likely that what is used and done will add value within and outside of the organization. This is illustrated graphically in figure 1.3.

For useful strategic planning, alignment of the five organizational elements—outcomes, outputs, products, process-

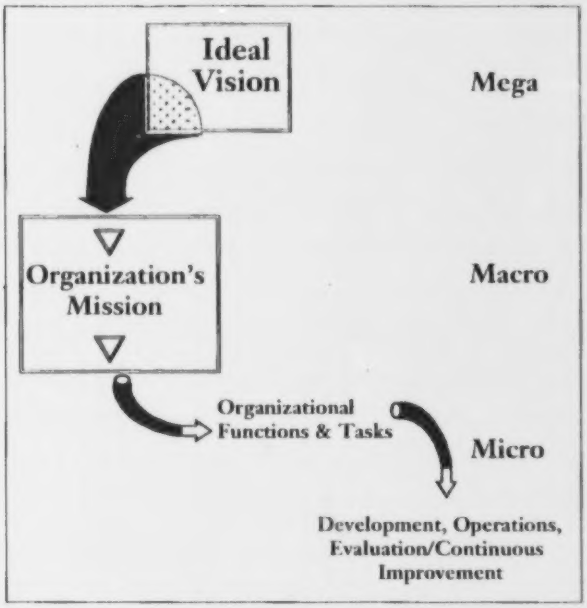
Ideal Vision
Mega
Organization's Mission
Macro
Organizational Functions & Tasks
Micro
Development, Operations, Evaluation/Continuous Improvement

Figure 1.3 Strategic Alignment Comes From the Organizational Elements Model by Rolling Down From the Mega-level to Macroplanning to Microplanning to Processes to Inputs (based on Kaufman 1998, 2000)

es, and inputs—is required. This OEM has three levels of results (outcomes, outputs, and products) and two levels of means (processes and inputs). Ends must not be confused or blurred with means and resources. Strategic planning begins at the mega-level (ideal vision) and then moves to macroplanning and then microplanning. Starting at a level lower than the mega-level is fraught with great risks for one can spend a lot of time, money, and resources for an institution that does not add value to society.

Why Use Megaplanning?

The planning process described above is different from the conventional wisdom for strategic planning and management in higher education. It is outside conventional comfort zones as well. So why should anyone go to the bother of even considering this new approach, let alone implement it?

Traditional strategic planning endeavors often simply attempt to increase the efficiency of current efforts, which typically amounts to working harder without working smarter. Improving one's techniques, methods, and efficiency and working harder will not suffice if the focus is on the wrong target. As a result, traditional planning approaches seriously confine efforts to current practices and incrementalism and, as a consequence, tend to significantly limit the real potential that mega-level strategic planning can bring to institutions and their futures. On the other hand, megaplanning, the strategic planning approach described in this chapter (Kaufman 1998, 2000; Kaufman, Herman, and Watters 1996), focuses on societal good and value added and related planning on the basis of an ideal vision—a statement of the kind of world we want in the future. It creates an ideal vision before scanning current and future opportunities and realities and then identifies useful strategies and tactics for advancing the institution and arriving at a better world. In particular, megaplanning starts with an understanding that the primary client and beneficiary of any educational enterprise is society. It empowers educational partners—learners, educators, and citizens—to define an ideal vision and develop from it a strategic plan and related tactical plan to achieve educational success with long-range payoffs.

Megaplanning's distinguishing characteristics (Kaufman, Herman, and Watters 1996) include the following:

- Oriented toward results and accomplishments, rather than toward means or processes.
- Places individual learner performance at the center of planning and management and emphasizes that both a learner's current and future success are vitally important.
- Gives a precise and rigorous way of ensuring that the social and personal uniqueness of each person is formally brought to the forefront of planning and used as an enhancer, not as an obstacle.
- Focuses on society—now and in the future—as the primary client of education; it is a proper balance of inside-out and outside-in planning.
- Generates an ideal vision that directs and inspires planners and holistic planning and provides a common basis for effective change creation (i.e., the process by which an organization and its stakeholders create a change from current results and methods to those required for the future; see chapter 2 for details).

No doubt, taking this suggested approach in higher education in particular and to planning in general will take determination and commitment. Does your organization have to change? It is interesting to note that Peters (1997) states that it is easier to kill an organization than it is to change it. Change expert Conner (1998) tends to agree. Will your organization be killed, or will it change to become demonstrably effective in adding societal value?

Isn't it vital to change—responsibly and responsively? And once your organization decides to change, how does an organization change and what does it change to? The "what to change to" is the product of the strategic thinking and planning discussed in this chapter. But change is always easier for someone else.[2] So, if change is on your agenda, and it should be, then strategic thinking and planning can help define and justify what you should change to, and the concept of change creation, discussed in chapter 2, provides the process and framework for "how to bring about the desired change."

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Notes

[1] The useful ground rules for creating or ratifying an ideal vision are: (1) only include ends and not means and (2) all results must be at the societal and community level. The ideal vision provided on pages 17–18 was derived from asking people, almost worldwide, to define in measurable terms the kind of world they wanted to help create for tomorrow's child. Then, all inputs, processes, products, and outputs were deleted to form what is the ideal vision on pages 17–18.

[2] Kaufman has a hypothesis: the more someone self-identifies as being in the "change business," the less he or she is personally able and willing to change. This hypothesis is supported perhaps by noted psychotherapist Harold Greenwald, who in his 1972 (Wyden/Edits) book *Direct Decision Therapy* noted that people tend to specialize in the area of their own greatest perceived weakness.

Dale W. Lick and Roger Kaufman

2

Change Creation: The Rest of the Planning Story

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This chapter acknowledges the rapidity of today's change and its growing complexity and significant impact. Accepting these as salient features that must be dealt with in any modern-day organization, we introduce a new, comprehensive planning and change concept, "change creation," that not only encompasses strategic planning, as discussed in chapter 1, but also involves a transition process for an organization from "what is" to "what should be." The discussion defines change creation, sets forth its key change concepts and related principles, and explains how to apply these concepts and principles in meaningful practice.

As part of change creation, every organization must respond (react) to change thrust upon it by changed realities. The management (i.e., control and integration) of such change is vital. At the same time as the reactive responses to change are operating, there is another part of change creation, times and circumstances when an organization must be proactive and not wait for the impact of overt change forces. In these situations, the organization identifies and creates the changes that will be required for a successful future. Consequently, change creation, while including change management, moves beyond it while dignifying its importance.

Failure of Change Efforts

Why do most of our significant change efforts seem to fail or be only partially successful? Leaders (e.g., the board, college and university executives/administrators, and faculty leadership) often avoid this question because it is natural to consciously or subconsciously fear the answer. But what is the answer? Typically, leaders would find the following.

- They had not fundamentally reframed their own thinking relative to major change. For example, effective leaders must be capable of reframing their own thinking and the thinking of those they guide, enabling them to see that significant changes are not only imperative but also achievable. Reframing often requires that old goals and objectives as well as cherished means and activities must be changed.
- They had implemented a strategic planning approach that is incomplete and inadequate for the massive, holistic, systemic change that is required, as discussed in chapter 1.
- They had failed to prepare their organization for the important transformations that major change requires. For instance, before people will seriously commit to being an important part of a major change, they must understand the essence of the change, appreciate why it is so important to the organization and internal and external stakeholders, and accept (both intellectually and emotionally) the implications of the change for themselves personally.
- They had not provided and implemented a detailed, structured, disciplined transition plan for identifying and then completing the major change, that is, a plan

that would transition people, processes, and, most importantly, the culture from the old paradigm to the new one.

Change

Change has always existed. The difference is that for today and tomorrow, the intensity (i.e., speed, magnitude, and momentum) of change, in almost everything, is so much greater. The nature of our times and the rapid development of amazing present-day technologies are driving change virtually everywhere to ever-increasing new heights, greater complexity, and more profound consequences, often very different than what the world had known earlier. Perhaps change expert Daryl Conner (1993) says this best: "Never before has so much changed so fast and with such dramatic implications for the entire world" (3).

In fact, change has become a silent juggernaut, a persistent, irresistible force marching on. It almost silently permeates everything and, frankly, is no respecter of persons, professions, or organizations, including faculty, academics, parents, communities, and higher education. An excerpt from a statement of the American Association of University Professors (see www.aaup.org/spcintro.htm) sums this up well.

> The world of higher education is in the midst of accelerating and sometimes turbulent change…modes of communication are profoundly affecting the work of faculty members: they are reshaping the processes of teaching and learning, redefining the role and authority of faculty members in organizing and overseeing the curriculum, and altering the bases for evaluating students—and faculty—performance. The implications…extend [to] major facets of higher education, deeply influencing its organization, governance, and finances. (June 1999)

However, how do those in higher education usually respond to this dynamic, ubiquitous change? Institutions and their people typically have chosen, consciously or by default, to resist, ignore, or sidestep the realities and impact of change, all losing and self-defeating responses. They often turn to change management in the hope that once a change is upon them, they can manage or control the change and its effects. Change management is reactive and requires a quick and nimble response to defining and managing change. This reactive approach frequently prevents one from defining useful change before being overtaken by it. In particular, change management is based on people sensing that their world, internally or externally, has changed (for example, the now-intense competition in distance/distributive learning from higher education institutions worldwide can no longer be ignored). On the other hand, to increase the potential for success, instead of an organization's being just reactive, the leadership must become proactive and define and then "join" change, embrace it as a partner, and use it creatively to advance the organization's goals and missions and society.

Learning is absolutely fundamental to change creation.

Change Creation

With dramatic and omnipresent change being the order of the day, it becomes harder than ever to predict the future. So what should be the approach to dealing with tomorrow? Business management guru Peter Drucker (1985, 34) simply and powerfully answers this critical question when he advises that since you can't predict the future, you must create it; that is, organizations must exploit change and create the future that serves society best. To do this, an institution and its people must become effective leaders and practitioners of change creation.

"Change creation" is the process whereby an institution and its people:

- Accept and even welcome change as a vital component in achieving future success.
- Define the future they want to design and deliver.
- Create the designed future and continuously make improvments while moving ever closer to the desired future. (Though some might see this as a contradiction with the suggestion that continuous improvement is required even while massive and rapid change is occurring, it is not. While changes might happen in large "hunks," internal adjustments must constantly be made to valid purposes to keep resources, means, and building-block objectives properly focused.)

Change creation is proactive. When institutions enact change creation, they intentionally move from being victims of change to becoming masters of change. This means taking genuine responsibility for leading change; effectively defining and planning for the desired change; comprehensively preparing the organization for the planned change; and developing and implementing a change approach that capably transitions its people, processes, and circumstances from the existing paradigm to the new, desired one.

How do institutions bring about change creation? In the next few sections, this chapter lays a foundation for key concepts and principles relating to change and change creation. The chapter then provides discussions for applying these concepts and principles in practice.

Roles of Change

An appreciation and acceptance of the four roles of change—change sponsorship, change agent, change target, and change advocate—aids in the understanding and meaningful utilization of the dynamics of change and in building required levels of commitment to bring about and sustain major change. A *change sponsor* or *sponsor* is a person or group who has the authority and legitimizes a change, such as a system or institutional board; a system chancellor; an institutional president; a dean, division director, department chair, or a combination of these individuals; the faculty senate; and the faculty itself. A *change agent* or *agent* is a person or group who is responsible for implementing the desired change, such as institutional administrators, administrative and faculty groups, and faculty members. A *change target* or *target* is an individual or group who must change as a result of the change effort, such as administrators, faculty members, and students. A *change advocate* or *advocate* is a person or group who supports a change but has no authority to sanction the change effort, such as administrators, faculty members, students, and noninstitutional people. Depending on the situation, an individual might perform more than one of these roles during different aspects of a change effort.

If a university, for example, were to consider a major new initiative to significantly upgrade its use of technology to achieve useful results and payoffs, the board and president who authorize the initiative might be initial sponsors for this change effort; the provost, deans, and department chairs who are responsible for implementing the initiative might be change agents; and the faculty and students who actually have to change to use the technology might be targets. Advocates might include other individuals and groups who encourage the initiative but are without authority to sanction it, such as business and industry representatives, alumni, and parents.

Effective Sponsorship

The four roles of change are all necessary for the success of a change initiative. However, initial and sustaining sponsorships are especially critical to the effective identification and subsequent implementation and completion of major change. For change efforts to be successful, sponsors must demonstrate, initially and continuously, strong, decisive commitment and support. Put another way, if strong relevant sponsorship is not available or cannot be generated for a change project, the effort simply should not be undertaken. Often the difference between success and failure in higher education change initiatives comes down to the effectiveness of the sponsorship.

Applying Conner's characteristics of strong sponsorship (1993, 114–15) in higher education, a strong sponsor must have the following.

- *Power:* Institutional power and influence to legitimize the change with targets.
- *Pain:* A level of discomfort with the status quo that makes change attractive.
- *Vision:* A clear understanding of what must occur—where you are headed and why you want to get there in terms of adding value to society.
- *Resources:* A thorough understanding of institutional resources (e.g., time, money, and people) necessary for successful implementation and the willingness and ability to commit them.
- *Long view:* An in-depth understanding of the effect the change will have on the institution and all of its stakeholders.
- *Sensitivity:* The capacity (i.e., willingness and ability) to fully appreciate and empathize with the personal issues raised by the change.
- *Scope:* The capacity to understand thoroughly the size of the group and programs affected by the change.
- *Public role:* The capacity to demonstrate the public support necessary to convey solid institutional commitment to the change.

- *Private role:* The capacity to meet privately with key individuals and groups to convey strong personal support for the change.
- *Consequence management techniques:* The capacity to reward promptly those who facilitate acceptance of the change or to express displeasure with those who inhibit it.
- *Monitoring plans:* The determination to ensure that monitoring procedures are established that will track both the progress and problems of the transition.
- *Willingness to sacrifice:* The commitment to pursue the transition, knowing that a price will most often accompany the change.
- *Persistence:* The capacity to demonstrate consistent support for the change and reject any short-term action that is inconsistent with the long-term change goals.

Whenever sponsorship is not strong for a particular change effort, your options are to strengthen the existing sponsorship, replace weak sponsorship with strong sponsorship, or prepare for the change effort to fail. Since strong sponsorship, as discussed previously, is both serious and demanding, one individual can effectively sponsor only a relatively small number of major change initiatives at any one time.

Learning

Learning is absolutely fundamental to change creation. However, most definitions of learning, as required in change creation, are incomplete and inadequate. Most often the meaning of the verb form of "learning" is something like "gaining knowledge of or skill in by study, experience, or being taught," and the noun form/intention of "learning" is "a knowledge acquired by study, experience, or being taught." Instead, a deeper meaning for these terms is proposed for change creation in what might be called "capacity" or "action" learning:

- *Learning (verb):* Gaining capacity (willingness and ability) for effective action.
- *Learning (noun):* Capacity (willingness and ability) for effective action.

When these terms are used in change creation circumstances, "effective action" is to be interpreted in relation to the totality of change being considered. "Ability" would include information, knowledge, skill, experience, and understanding as well as such characteristics as nuances and qualities that would enhance effective action. Also, notice that capacity in this discussion requires both willingness and ability. If either willingness or ability is missing, you don't have capacity.

Learning, as more broadly described above, involves a "fundamental shift or movement of the mind," as learning organization expert Peter Senge (1990) relates:

> Through learning we re-create ourselves. Through learning we become able to do something we never were able to do. Through learning we re-perceive the world and our relationship to it. Through learning we extend our capacity to create, to be part of the generative process of life. There is within each of us a deep hunger for this type of learning. (13–14)

This kind of learning is essential to change creation.

Universal Change Principle

Unfamiliar major change almost always generates fear and anxiety in people, often requiring them to radically shift their thinking, feelings, beliefs, and behaviors. It usually requires a shift in the system of rewards, and with that shift comes uncertainty. Consequently, the more individuals understand and accept about a change, the more comfortable and committed they tend to become to it. Such understanding gives people a sense of control over the change or a greater ability to anticipate relative to the change, contributing to their sense of comfort and security and lessening their resistance to the change (Conner 1993). These ideas and learning, as defined in the previous section, are the foundation for the seemingly simple but powerful overarching principle for change creation, the universal change principle. It is directly or indirectly applicable to essentially all change-related initiatives and is defined as follows:

Universal change principle: Learning (both as a verb and noun) must precede change.

A simple illustration of the universal change principle is the following:

> Instead of just throwing money and computers at faculty members, the university responded to its technology requirements with a summer training program on how, when, and why to use computers and computer support. Now, a few weeks into the new semester, those lessons seem to be paying off: faculty are positively involved, things are running efficiently, and learner performance has improved.

Although the application of this principle does not guarantee that resistance to change will be eliminated and that a desired change will be accomplished, its proper application does significantly improve the chances for success with a change effort. Notice that the principle implies no surprises, since it requires that learning must precede any change. For major higher education initiatives, often there must be significant learning preceding change, such as several planned, multidimensional, many-level iterations of appropriate learning over a substantial time period. The likelihood of people reacting favorably to change and assisting with it will be enhanced greatly if time is taken to provide a basis of learning and understanding about the change.

It frequently is helpful to state the universal change principle symbolically as

$$L > C,$$

where L represents learning (as a noun) and C represents change. The complete expression states that "learning is greater than change." To have change, you first must have learning. Notice that it says that for success of a major change effort (i.e., a large amount of change), there must be a lot of learning that takes place first. In particular, for a major change, several iterations of learning may be required over time across a number of sectors of the institution, depending on the change, circumstances, and people involved. As a practical matter, it is usually beneficial to develop a plan before announcing a desired change. This plan, based on the universal change principle, would detail a series of appropriate and necessary learning dimensions, opportunities, and repeated applications required to implement the desired change.

For example, suppose the chair of the mathematics department wants her faculty to implement a new technology-driven teaching approach in calculus. If the chair just announces that the faculty will use this new approach next semester, probably most of the faculty will feel uncomfortable with the proposed change and resist rather than help facilitate the chair's decision. If, on the other hand, the chair employs the universal change principle, she would, before any announcement was made, consciously ask, "What learning must take place before this change effort can be successfully implemented?" For instance, learning opportunities for and dialogues with the faculty about the new teaching approach might include why the new approach is critical to improving student learning; what the implications are for students, faculty, and the department; when and how this new approach will be implemented; and what will be the support and rewards for effectively implementing the new approach.

Higher education institutions have strong and rigid cultures that vigorously protect the status quo—self preservation.

Cascading Sponsorship

The *initiating sponsor* of a change effort is the initial individual or group that first legitimized it. What is also required for successful change are other sponsors down in the organization, *sustaining sponsors*, who continue and sustain sponsorship for the change effort for those in their arena of influence. For example, in a major university change effort, the president might be the initiating sponsor and the provost might become a sustaining sponsor of the effort with the deans; that is, the provost, as a sustaining sponsor, would provide ongoing sponsorship of the change effort for the deans. All sponsors must, in both word and deed, be consistent and continuing in their support.

When there is a difference in strategic commitment to a change effort between the initiating sponsor and the target, the one who must change, the change is likely to fail. To overcome this problem, the initiating sponsor must enlist or generate the support of sustaining sponsors down in the organization who have the target in their arena of influence. In general, a sustaining sponsor must set, in the arena of influence of the target, an agenda of importance and consequences so that the target will accept and commit to the change effort. For instance, in a university, the president sets the agenda of importance and consequences for the provost, the provost for the deans, deans for department chairs, and chairs for the faculty.

Cascading sponsorship is the process of generating sustaining sponsorship from the initiating sponsor down into the organization through the chain of command to a level directly influencing the target. Cascading sponsorship in a university from the president as initiating sponsor to the faculty as the target would require that the provost, dean, and department chair all become sustaining sponsors. Cascading sponsorship is essential for change creation. The stronger the sustaining sponsorship in the chain of command, the better the chance for a successful response of targets to the change effort.

Culture

Higher education institutions have strong and rigid cultures that vigorously protect the status quo—self-preservation. These cultures are among the strongest and most rigid in society, far more so than those in business, industry, and government. Consequently, for change creation to be effective in higher education, we must understand more about college and university cultures and how to modify them appropriately.

The *culture* of a higher education institution is its collective essence—fundamental nature and inherent characteristics—and, in a sense, its personality. The culture serves as a common bond for those in the institution, holding together the educational and educationally related aspects of the institution and creating the central features, structures, and approaches that characterize it. The culture is "how we think about and do things around here." Although not always visible, the culture is a powerful force that is always present, setting and then differentially rewarding given values and establishing ground rules for what people assume to be important and true and for how they think and behave. Among elements of the culture are accepted paradigms; norms and values; organizational structure; career paths; leadership and management; forms of communications; power and status; things measured and controlled; policies and procedures; institutional stories, legends, myths, rights, rituals, and symbols; design and use of physical facilities; and reward systems.

From a change creation perspective, culture reflects the interrelationship of shared assumptions, beliefs, and behaviors that are acquired over time by members of the institution and are defined in the following paragraph (Conner 1993).

Assumptions are usually unconscious and unquestioned perceptions concerning what is important and how people and processes function within the institution. For example, faculty members hold the unconscious assumption that lecturing to students provides a good form of learning, whereas educational research indicates that it is one of the least effective strategies for student learning. *Beliefs* are values and expectations that people hold to be true about themselves, others, their profession and work, and the institution—what they believe to be right or wrong, good or bad, or relevant or irrelevant in their institution and its operation. Beliefs and values are largely unexamined preferences for means and resources and rarely relate to ends, consequences, and payoffs (Kaufman 2000). *Behaviors* are ways people conduct themselves on a day-to-day basis, such as how to teach, evaluate students, and introduce technology. Performance is the result of behaviors—it is what happens as a result of behavior.

Cultural change is extremely difficult in higher education but required. For successful innovation, an institution of higher education must alter some of its cultural building blocks—assumptions, beliefs, and behaviors—for meaningful change creation to take place. Simply put, for colleges and universities to be fully effective in tomorrow's world, they must learn how to create new cultures (cultural shifts) that best suit their needs (gaps in results) and wants. Resistance to change relating to the culture is noted by Peters (1997) when he suggests that it is easier to kill an organization than to change it. Thus, there seems to be a choice: change responsibly or, over time, die or become increasingly irrelevant. (It might be initially tempting for higher education professionals to assume that so much is invested in infrastructure, faculty, and buildings that they are not likely candidates for extinction. This is yesterday's thinking. There is every reason to believe, as we see the dramatic change outside our comfortable campus environments, that the nature of the higher education experience is changing radically. For example, distance learning—greatly ignored as a fad and inconsequential for many years even though related initiatives, such as the British Open University, were gaining quiet acceptance—is rapidly competing for larger numbers of learners simply by shifting the focus from on-campus, teacher-oriented learning experiences to learner-oriented ones. Consequently, implications for further investment in buildings and conventional teaching equipment are huge and closing on us quickly.)

Conner (1993) provides a practical principle for understanding and dealing with the juxtaposition of culture and change. Whenever a discrepancy exists between the current culture and the objectives of your change effort, all other things being the same, the culture always wins. So, when facing an organizational culture that may hinder a desired change effort, your options are to:

- Modify the change effort to be more in line with the existing culture.
- Modify assumptions, beliefs, and/or behaviors of the current culture to be more supportive of the change effort.
- Prepare for the change effort to fail (176–78).

Assimilation Capacity

Institutions of higher education are constantly filled with change projects. This is a serious problem for the faculty and staff, operational groups, and the institution itself. Individuals, groups, and institutions only have limited capacity to deal with change, their ***assimilation capacity***. For instance, when an individual's assimilation capacity is surpassed, he or she becomes dysfunctional—the individual continues to function but performs below normal levels of productivity and quality. Similarly, groups and institutions can become dysfunctional, performing at lower than optimal productivity and quality levels.

Often, excessive change represents reality in today's colleges and universities. Most of these change projects are well received, make sense, and have some value but are not imperatives—change efforts that will significantly improve the institution, its operation, and those it serves. To be truly successful, the institution must identify and make the critical, difficult, and painful decisions that allow the institution to eliminate unnecessary (nonimperative) change efforts and devote the bulk of its time, talent, resources, and assimilation capacity to imperative changes, those that will have significant impact and best meet the institution's mission and goals.

Process of Change Creation—An Overview

Change creation, as defined earlier, is very difficult to accomplish in higher education. Consequently, as expected, the process for change creation is extensive, complex, and multifaceted. An outline of the recommended *change creation process* is given here:

- Prepare the leadership team for major planning (i.e., for defining the world and organization it would create for tomorrow) and change.
- Prepare the institution for major planning and change.
- Complete mega-level strategic planning (see chapter 1 or Kaufman 1998, 2000), including statements of an ideal vision, a related mission, and objectives. (An ideal vision is the measurable statement of the kind of world desired to be created for tomorrow. It focuses on societal results—ideal results such as a zero murder rate and every citizen being a positive contributor to the self-sufficiency and quality of life of self and others.)
- Describe, in written form, each major change project to be undertaken for plan accomplishment. (Remember that multiple change efforts require interrelating.)
- Clarify the scope of the change project and the level of commitments essential for its success.
- Communicate the change project and its importance and implications to stakeholders (e.g., administrators, faculty, staff, students, alumni, parents, and key community leaders).

- Diagnose the institution's present status and capacity to accomplish the change project (e.g., institutional readiness for change, assimilation resources, cultural issues, and strength of sponsorship).
- Create, using the universal change principle, a detailed action plan for the implementation and long-term success of the change project.
- Execute, monitor, and refine (continuously improve) the implementation plan.
- Assess and report regularly the progress and status of the change project to stakeholders, seek their input, and celebrate success milestones.
- Evaluate the final results of the change project.

(For related sources see ODR 1993; Addison and Lloyd 1999; Bridges 1991; Norris and Morrison 1997).

Each part of the change creation process listed here is discussed in detail in the sections that follow. Keep in mind as you consider these parts of the process that the more seriously and meticulously they are applied, the more likely they are to be effective and successful.

Step 1: Leadership Team Preparation

Often planning and change efforts fail before they even get under way. Why? Because those who are to lead and sponsor planning and change projects do not understand the substance of the efforts or their complexities and ramifications, or they are not genuinely committed to them. Remember, to have such capacity, there must be willingness and ability for leading and sponsoring planning and change. Too frequently, one or both of these are missing or not adequate. Before a major planning or change effort is seriously instituted, those who are to be initial leaders and sponsors, especially the principal initial leader and sponsor (e.g., the president), must reasonably understand such undertakings and their consequences, be both intellectually and emotionally committed to them and what it will take to help them unfold successfully, and be prepared and willing to fulfill the strong sponsorship role discussed in an earlier section. To these ends, those involved in planning and change efforts may find it critical, at the onset of such considerations, to delay moving forward so that they may apply the universal change principle (learning must precede change) and to learn (gain capacity for effective action) those things required (willingness and ability) to prepare them for effective initial leadership and sponsorship. Without strong and effective leadership and sponsorship, the planning and change effort is almost certain to fail or at best be only partially successful.

Further, the composition of the initial leadership/sponsor group may also inhibit meaningful progress or fail to lay a foundation for enhanced success. In higher education, with more of a "shared governance" psychology and practice than in other society sectors, this group must be more broadly based than to include just high-level administrators. For most institutions, success will be improved, possibly markedly so, with other key institutional members intimately involved, such as influential faculty members, staff, and students. Under certain circumstances, it may even be wise to include other representatives (such as board members, alumni, and community leaders). Initiation of planning and change efforts by a strong, well-prepared, partnering, broad-based leadership/sponsoring team gives these efforts real credibility with others and a jump start toward success.

People cannot march off in different directions and expect to get to the same place.

It is recommended that a common North Star, an ideal vision, be utilized to place the institution into the context of society. An ideal vision states in measurable terms the kind of world you want to create for tomorrow. Hence, an institution can define those parts of that ideal vision it commits to deliver and move ever closer to that vision. This allows all to share the common destination and define how they can uniquely contribute to its accomplishment.

Step 2: Institutional Preparation

Once the leadership team has been adequately prepared for the initiation of planning and change, it is ready to lead the preparation of the institution for such. Since a new planning initiative represents major change, it is at this point that the universal change principle must come into play prominently. It tells the team (and its project coordinators) to intentionally ask, "What learning (i.e., capacity for effective action) must be provided for the institution's stakeholders to prepare them, intellectually and emotionally, for the initiation of the specifically chosen planning and change effort?"

The response by the team, appropriate leadership team members, and others must include, at a minimum, the communication and sharing with institutional stakeholders of enough learning about the planning effort for stakeholders to gain a plausible sense of the effort, its long-term importance to the institution, and its implications to them and others for whom they have concern. The stakeholders will only be comfortable with the planning effort if they feel some sense of control in the process or at least are able to anticipate what will be happening and why and how they can contribute. Otherwise, they will be fearful, not feel trustful of the people and process, tend to have negative rather than positive thoughts about the effort, and probably resist it. Time spent at this phase of the initiative to provide appropriate stakeholder learning and institutional preparation will help create the beginning of a change-adaptable foundation for stakeholders and pay off later.

Step 3: Mega-Level Strategic Planning

A vital part of truly meaningful change creation is effective strategic planning. Mega-level strategic planning (Kaufman 1998, 2000) is strongly recommended at this point (see chapter 1). It differs from conventional approaches in that it places societal value added as the basis for all subsequent planning, developing, implementing, and evaluation/continuous improvement. It is proactive (and thus aligned with change creation) and allows stakeholders to become active partners in defining new destinations for higher educational institutions rather than simply attempting to make the current destinations and curriculum more efficient. An analogy is that no matter how well designed the methods and complete the resources, they will not make up for having the wrong targets.

With the institutional preparation completed, as described previously, the institution is now ready to embark on its strategic planning effort. Among results from the planning process will be statements of an ideal vision, a mission, and objectives for the institution. These will provide the framework and direction for the balance of the change creation effort, especially one or more major change projects. Mega-level planning defines society as the primary client and beneficiary of everything an organization uses, does, produces, and delivers (Kaufman 1992, 1998, 2000).

Step 4: The Change Project

The strategic planning process will generate one or more major change projects that are essential to the accomplishment of the original change creation effort. For example, suppose the desired change creation effort involved preparing a university to become a leader in distance learning. The strategic plan for this change creation effort would no doubt lead to a major change project for the integration of educational technology into the university. In this section, we will discuss just one change project resulting from the strategic planning process. However, the strategic planning process will typically generate more than one change project. In such an event, each change project should be handled in a manner similar to the subsequent discussion. In addition, care must be taken so that these change projects are dealt with in a system approach (and not a systems approach), recognizing and reflecting their interrelationships and interdependencies. (A system—singular—approach has society as its overarching client and beneficiary. A systems approach, however, focuses on the parts and pieces—systematically and systemically—of the overall system [Kaufman and Watkins 2000].)

When a change project is conceptualized, it is essential that the project be described in sufficient detail and in writing so that all stakeholders have, in essence, the same understanding of the project and its parameters and expectations. Frequently, the initial change leader/sponsor has a sense of the project in his or her head and maybe even something outlined on paper. But these are inadequate for the broad understanding that the leadership team and other stakeholders must have. In fact, lack of reasonably comparable stakeholder understanding of a change project is often a prime cause of its failure. People cannot march off in different directions and expect to get to the same place. Putting the change project description in writing allows all stakeholders the opportunity to read, study, and more likely gain a common understanding of the project. A common sense of the project means that the chance of a critical mass of stakeholders working together for a successful conclusion is significantly enhanced.

Step 5: The Scope of the Change Project

Before an institution announces a major change project, it is important to make sure that the leadership team and those initially charged with its implementation (i.e., the change agent team) are in agreement on the project's scope and basic commitments essential for its success. In particular, preliminary discussions and agreements are important on:

- Why the project is imperative (e.g., what critical needs—gaps in results within and external to the organization—will be closed or reduced).
- Where the project is starting.
- Expectations for the project (e.g., the desired results).
- The transition (i.e., change) process.
- Method for success determination (i.e., the rigorous criteria for determining and demonstrating progress toward success as well as the accomplishment of internal and external value added).
- Commitment of initial sponsorship, especially the leadership team and its members (see the characteristics for effective sponsorship described earlier).
- Consistency of the project relative to related culture or subcultures.
- Past history of change at the institution. The past history of change at an institution often provides helpful information for identifying possible blocks and risks that must be overcome.
- Restraints and barriers (e.g., time, money, and resistance) for the project.
- Seriousness of disruptions as a result of the project.
- Availability of assimilation capacity at the institution (e.g., few existing change projects in progress or many). This important variable is to ensure that the resilience or change-adaptability of individuals, groups, and the organization is high (e.g., that they are not already oversaturated by change). The earlier section on assimilation capacity outlines this area of critical concern.

These discussions help those involved understand the change project better; surface potentials, strengths, pitfalls, and weaknesses; enhance personal and functional relationships among the participants; give a sense of direction and anticipation for the unfolding of the project; and allow for a more broadly based consideration of the project and its likely success or failure. This is the decision point for taking the change project public. When significant, genuine concerns arise from the discussion of the preceding items, reflecting a high risk for failure of the change effort, leaders should not go forward with the project or they may revise it substantially or modify the project's circumstances before continuing with the change effort.

Step 6: Communication of the Change Project

The group responsible for implementing the change effort, as discussed in the earlier section on roles of change, is the change agent team. Now that the leaders/sponsorship and initial change agent teams have a good understanding of the change project and the decision has been made to go forward with it, the next step is communicating the project to the larger institutional audience (i.e., all appropriate stakeholders). This is a good opportunity to make that all-important first impression—the beginning of the "understanding and buy-in" process. Further, for the larger institutional audience, this communication effort represents the onset of change, which may include having a new perspective; reexamining beliefs; questioning underlying assumptions; shifting behavior and related performance; and dealing with arising implications for them and others and what they think, value, and do. Frankly, just the announcement of the change project alone can bring fear and resistance if not handled with care.

For the communication of the change project to be effective, it must be treated like dealing with change and must call on the universal change principle (learning must precede change) for assistance. Consequently, the communication approach must be planned and executed well. With specific focus on the change project, the communication process should:

- Identify the constituencies (i.e., stakeholder groups) requiring awareness of the project.
- Analyze its initial "learning" requirements for each constituency to help each group gain a reasonable sense of the project, its importance and implications, and the effects of positively receiving it, including payoffs for changes to all stakeholders.
- Develop a communication plan (i.e., learning plan) tailored to each constituency, including what will be done, how it will be done, and who will do it.

Remember, the communication effort must be carefully designed for and targeted to each constituency separately, and there is only one chance to make that important first impression that later will be hard to change.

Step 7: Diagnosis of Status and Capacity

There is no guarantee that any major change project can be successfully managed to completion. However, what can be said is that by reducing change risks that exist for a specific change project, the chance for its success is enhanced. Thus, if the risks in a change project can be identified and reduced substantially and the elements of existing capacity can be found and used meaningfully, then the probability of moving the change project to a successful conclusion is increased significantly. This is what effective change management is all about. Consequently, the diagnosis of the institution's present status and its capacity toward accomplishing the change project become critical to the success of the change project.

In the earlier section on the scope of the change project, we raised and discussed a number of institutional status and capacity elements in a preliminary fashion. The results of those preliminary considerations and assessments assisted the leadership team in their decision about advancing the project and later in how best to communicate it to the stakeholder groups. Although those initial findings were helpful, they are usually incomplete or lack the depth necessary for a full reflection of serious change risks and potentially beneficial capacities. As a result, the leadership and change agent team must, earlier in the transition effort, provide diagnoses of the institution's status and capacity factors. Among those that are especially critical are the institution's change history, knowledge of change, and readiness for change; management of assimilation resources; cultural issues and reward structures; level of sponsorship; and target commitment and resistance.

For example, if an institution has a positive change history where change projects are commonly initiated, supported, and completed and a high level of trust has been created between the administration and faculty, then future change projects are at much less risk and have a much greater chance of success. On the other hand, if an institution has a checkered past relative to change efforts, then, typically, change will be harder—there will be reduced trust, change risks will be greater, and more change foundation enhancements will be required for a major change project to be successful.

These diagnoses provide the leadership and change agent team with especially valuable information for putting together an effective transition/implementation plan for the successful completion of the change project.

Step 8: Detailed Implementation and Transition Plan

Described in earlier sections were approaches for preparing the leadership and institution for the strategic planning effort and change, the announcement of the implementation of the change project, and diagnoses of the related institutional status and capacity toward the accomplishment of the change project. With this foundation in place, it is time to develop a detailed action plan for the implementation and long-term success of the change project. This plan must not only lead to the transition of processes and circumstances from the old paradigm to the new one but must, most importantly, effectively provide for the transition of a critical mass of the people from the old to the desired paradigm. For instance, leaders can say and do what they want, but if the targets, individuals who must change, don't do it, it doesn't get done. Covey (1990) expresses well the underlying psychology for understanding and dealing with people in transition:

> People are very tender, very sensitive inside. Age or experience makes little difference. Inside, even within the most toughened and calloused exteriors, are the tender feelings and emotions of the heart. That's why in relationships, the little things are the big things. (192–93)

Further, this tells us that for people to really buy in to a change, they must commit to it not only intellectually but also emotionally, a vital notion to be kept in mind during transition plan development and implementation. The transition plan will contain a many-level, multidimensional, iterative process that will unfold over time and affect everyone directly or indirectly involved in the change project. The universal change principle (learning must precede change) now becomes the key tool for the design of the plan. In a comprehensive manner, each facet (e.g., structure, process, people, and culture) of the institution involved in the transition must be identified and a specific subplan must be developed (using the universal change principle) for the transition relating to that facet. These individual subplans must then be implemented in a coordinated fashion, over time.

Among the many facets to be considered and questions to be asked, for example, are what learning (capacity for effective action) must be provided to:

- Help people deal with the change history of the institution, becoming more trusting and change-adaptable?
- Enlarge stakeholders' knowledge and understanding of change, increasing their resilience and the institution's assimilation resources?
- Enhance the institution's readiness for major change, including expanding stakeholders' understanding and visualization of the change project; its importance, long-term benefits, and personal implications (including reward structures); the transition process and their involvement in it; available resources; and the institution's full commitment to the effort?
- Eliminate some of the institution's nonimperative change efforts and focus on imperatives, conserving assimilation resources?
- Strengthen and continue sponsorship relating to the change project?
- Prepare change agents for their critical role of effectively implementing change?
- Reduce the resistance in targets and increase their commitment?
- Expand the powerful impact of advocates?
- Cascade strong sponsorship from the initial sponsor down through the hierarchy to targets?
- Transform the culture/subcultures, allowing the change project to succeed and be sustainable over time (e.g., appropriately modifying existing assumptions, beliefs, behaviors, and reward systems)?

Step 9: Execute, Monitor, and Refine

For a major change project, the transition plan developed above will be a huge, overarching approach to change that contains a many-level, multidimensional, iterative process for transitioning people, processes, and circumstances from the old paradigm to the new one. It will be a broad-based approach with various parts unfolding, as planned, in a coordinated fashion over a substantial period of time with learning opportunities and other activities being provided sequentially or simultaneously.

The change agent (i.e., implementation) team, in conjunction with the leadership team, will initiate the execution of the plan, monitor its processes and developments, and coordinate the plan's unfolding to project completion. As an important part of its assessment and monitoring and coordinating responsibilities, the implementation team should track the progress of the change effort and formally report on the status of it periodically to the leadership team.

Since the transition plan is a reasonably massive undertaking, it can be expected that not everything will work as planned and that not all that was required for the change effort was included in the plan. Hence, as the plan unfolds, alterations, sometimes substantial ones, must be made midproject to increase the likelihood of project success. Surprisingly, shortcomings or failures, if noted and understood, can often prompt refinements and modifications of the transition plan that improve chances for long-term success. For example, data collected might signal that external realities are not being properly considered. Also, this step must parallel megaplanning so that both change management and change creation become the twins of organizational success.

Step 10: Communicate Progress to Stakeholders

One of the vital functions of the transition plan is to help people move from their attachment to the old paradigm and become committed to the new one. This may be the most difficult part of the entire change effort. Consequently, care must be taken to ensure that those involved, directly or indirectly, are given a sense of comfort with what is happening in the transition process. Since people have a reasonable comfort level with change when they feel a sense of control or at least can anticipate what is happening or going to happen, it is critical that the progress and status of the unfolding change process is regularly and effectively communicated to stakeholders and that they are given opportunities for additional input. This also strengthens trust and synergy across the institution. In addition, the process can be enhanced even further with the celebration of success milestones, making project accomplishments victories and motivations for everyone. Similarly, effective change creation—defining what change must be accomplished and justifying why that change is vital—also provides comfort to most since they have had an active role in defining their future.

Step 11: Evaluation of Final Results

To be accountable, every project should have a "final" evaluation of its results so that results are known and lessons learned may be appropriately applied in the future. This step provides an objective and systematic collection of information and data to help the leadership team and others determine the extent to which various aspects of the change project have been accomplished. And the final results should be communicated meaningfully to stakeholders, helping to build their understanding, trust, and buy-in.

Equally important, though, can be the lessons learned from a thorough evaluation of explicit and implicit aspects of the project. Since most institutions in the future will be dealing with ongoing, overlapping change, each new change project within the institution can benefit from the lessons learned from an earlier change effort, potentially enhancing its effectiveness. In particular, lessons learned might include such things as what worked and what didn't work; understanding of an institution's change history—trust level, successes, and failures; stakeholders' level of resilience, assimilation capacity, and change knowledge; institution's and leadership's readiness for change; institution's ability to eliminate routine change initiatives and focus on imperatives (i.e., high-priority needs); sponsorship strengths and weaknesses and competence at cascading sponsorship; effectiveness at preparing change agents and reducing target resistance; skill at utilizing advocates; and understanding of underlying assumptions, beliefs and values, behaviors and performance, and reward systems of the culture and subcultures and capacity to modify them.

Summary

Change creation is a proactive process whereby change is an accepted reality—and even welcomed—as a fundamental part of future success; the desired future is defined, justified, and designed; and then a transition plan to create the designed future is developed and implemented. When change creation is enacted, an institution and its people consciously move from being victims of change to partnering with and mastering change. This means taking genuine responsibility for leading change, effectively planning for the desired change (i.e., strategic planning), and developing and implementing a change approach that capably transitions people, processes, and circumstances from what exists to the shared desired future.

All of this implies that effective strategic planning, as discussed in chapter 1, is essential to effective change creation but is only one key element in the critically important change creation process. The concepts, activities, and procedures in this chapter, though complex and demanding, outline a detailed map for effectively planning and implementing meaningful change creation in higher education.

Change creation is, indeed, the rest of the planning story.

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Gretchen M. Bataille

3 Academic Leadership Strategies: Partnerships for Change

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Colleges and universities have been described as slow to change, ivory towers disconnected from reality, and grounded in the past rather than in the future. Unfortunately, many of these perceptions are accurate. Increasingly those inside the academic environment recognize this; however, transformational thinking that results in radical change in response to technological and societal shifts is difficult to accomplish. When spokespersons such as Peter Drucker predict that in 30 years colleges will be "relics," academics, particularly administrators, frequently huddle together to protect what they have rather than figure out how to ensure that this won't happen (Frances, Pumerantz, and Caplan 1999). Colleges will still exist out of necessity, but the institutions that succeed will have secured the resources to transform themselves.The role of institutional academic leaders is to ensure this process of transformation takes place.

Environmental Change and Its Impact

The environment surrounding higher education has changed dramatically. Where once colleges and universities could operate in a relatively stable environment, the external world has become turbulent. Change is rapid, politics affects funding as well as programmatic directions, and universities are repeatedly challenged to look to corporate models to effect academic transformations. Frequently those admonishing higher education's leadership come from outside the university environment and believe that new technologies are a panacea for the changes they seek. Certainly, technology has made it possible to go on the Web and get instantaneous information from all over the world. Students can communicate with many people at any time of the day or night, and increasingly they can be students at different institutions simultaneously. Physicians can do diagnostics on X rays that have been transmitted electronically, and the expertise of the world can be brought to bear on questions that baffle experts. Students, faculty, and administrators are being forced to learn at a more rapid speed than ever before, and they need knowledge summarization techniques that can absorb all this information and present it in a useable form. As administrators in higher education, we face challenges unlike those of the past. The slow pace of change in educational institutions, often a byproduct of shared governance, has always given us time to think, react, or wait for others to make decisions. The rapid changes in technology do not afford us this luxury, requiring educational leaders, both in the faculty and the administration, to challenge the old models and move more quickly.

A large part of the old model is the academic bureaucracy, inflexible and slow to change. Faculty senates; departmental curriculum committees; boards, trustees, and regents; and administrative committees at institutional, systemwide, and state levels complicate the process of change. The entrenched culture of most institutions forces them to maintain the status quo rather than to take risks. The structure as well as the culture of higher education needs to become innovative and more venturesome, and there needs to be tolerance for ad hoc decisions and flexible models.

The immediate response to change in most institutions is a defensive one; arguing that higher education has served this country well, which indeed it has. We don't need to be defensive; we need to expand our strategies to encourage proactive and entrepreneurial activities that engender change. The critical piece in making change possible is a change in management style and structure in higher education. The authoritarian model based on age, tenure, seniority, and title must give way to a highly collaborative model that recognizes the strengths of young faculty, the creative energies of students, and the partnerships that can evolve between universities and industry. Hierarchy must give way to a systems-based approach to higher education that obliterates centuries-old organizational lines, whether between academic disciplines or among the various units of the university, such as student affairs, academic departments, the library, financial systems, or even recreational centers. To make such changes possible, administrators must be willing to give up some authority while retaining their overall institutional responsibilities.

Technology and the "New University"

Technology that makes possible new ways of teaching and learning is the most obvious motivator for institutional change, although it remains only a tool. How universities choose to use technology is the issue. Technology and information *do not need* universities to provide information or facts. The Internet provides information to anyone who connects. What the university does is transform information to knowledge and learning. The degree to which universities embrace technology and use it to transform information will be the measure of success for the university of the future.

What is the profile of this "new university"? Universities of the future must be network based rather than geographically based. The challenge to institutions will be to build relationships and maintain community within this new network-based environment. There will be benefits to new definitions of place. Students will experience learning in new ways, blending old definitions of formal and informal education. There will be greater opportunities for interactions between education and industry and private and public institutions. A more distributed system of education makes the university, the home, the place of employment, and the community of residence all a part of education. Students will be able to access higher education in different ways at different times depending on their own living and learning situation.

How will this "new university" change the models of delivery of education? The curriculum will be focused on active learning rather than passive absorption. No longer will the delivery model be defined by a professor at the front of a lecture hall. Students will participate in chat rooms, and they will be required to take the initiative in accessing information and asking questions. They will become designers of their own education as well as consumers of knowledge. Faculty talk a lot about critical thinking skills, but seldom do students have the opportunity to use these skills in academic programs that are driven by credit hours and course requirements. New approaches to competency-based education will remove expectations of numbers of credits and "seat-time." Critical to student participation in the educational process is that they must become aware of their own needs and take responsibility for their own learning. Universities must find ways to encourage and manage this new paradigm through expanded student services and access through the Internet. More critical, faculty must learn to be a part of the learning process rather than only function as the expert in front of the room.

The world has emerged from the Industrial Age into the Information Age; it is critical that we now move to the Knowledge Age. The world economy is driven by education, and a knowledge society is driven by ideas and creativity—the use of information. In a knowledge society, education at all levels matters because it is the driver of the economy. It matters too, because it provides the margin of difference between competency and excellence.

It goes without saying that we must invest in education on an ongoing basis. Such investment is critical to the nation. A knowledge society requires more than an investment in K–12 or four-year institutions; a knowledge society requires investment in lifelong learning. Education itself is being redefined as the need for new knowledge and skills develops. Public and private institutions, K–12 systems, community colleges, baccalaureate and graduate programs, and corporate education have all become a part of the new definition of education. As colleges move to offer courses in the high schools through partnerships and corporations deliver university courses, the demarcations among educational providers have blurred. The paradigm has shifted further in that we can't just expect an apprenticeship, a certificate, or even a Ph.D. to be the only mark of education. A learning society requires that we ensure education to everyone throughout his or her life or the society will not be a just society. A society of have-nots is spawned by inaccessibility to education, and increasingly education is defined by the technologies it incorporates. References to the "digital divide" remind us that many in society still do not have access to the technology necessary to succeed. It is not only individuals but also institutions that are divided by their accessibility to technology. A new societal and governmental responsibility in response to technology must be to ensure accessibility to the new modes of delivery.

Students will experience learning in new ways, blending old definitions of formal and informal education.

The traditional mode for delivering distance education has been to send a faculty member out into distant, frequently rural, communities. Some institutions expanded the definition of distance education by using videotape as the technology of choice. As technology advances, we need to continue to be responsive to students who have varying or multiple ways of accessing information. Critical to these changes is preparation in the K–12 systems. Until elementary and high schools throughout the country provide students with experiences and courses that result in technological literacy and until everyone has access to the Internet, wholesale changes won't be possible. At the same time, universities will need to find ways to deliver education that recognize the differences, both economically and technologically, of the audience seeking higher education programs.

Washington State University's Approach

Washington State University is a land-grant university with a residential campus in rural Pullman and three branch campuses—in Spokane, Vancouver, and the Tri-Cities area of south-central Washington. Named the "most wired" public university by *Yahoo Magazine*, the university continues to build on administrative decisions made over the past 15 years to transform WSU into an institution responsive to new technologies (Bernstein 1999). In addition to creating three branch campuses, WSU began a distance education program in 1992—the Extended Degree Program (EDP)—that focuses on baccalaureate completion. Students with the equivalent of two years of lower-division courses can enroll in a degree-completion program in any of five areas. This program initially focused on the adult learner who is bound by time and place. Enrollment in the EDP has grown from 52 students in 1992 to more than 1,000 during the fall of 1999. The clientele has changed from primarily adults to a growing number of students on college campuses who need courses that are not offered during a certain semester or whose schedules make flexible enrollment more appealing. WSU's program reaches students throughout the United States and in many foreign countries.

New technologies have made it possible for the EDP to modify its course delivery methods. While previously students received courses by videotape, now that students have greater access to computers and the Internet, courses are being converted to digital courses in WSU's newly configured Center for Teaching, Learning, and Technology (CTLT). The CTLT provides an infrastructure for the development of digital courses, the integration of technology into on-campus courses, and the assessment necessary to ensure quality. Funded by existing university funds as well as new funds appropriated by the state legislature, the CTLT is quickly becoming a model for a single unit that supports both course development and assessment. This was accomplished primarily because of institutional leadership—a president willing to take risks hired administrators who were charged with the responsibility of expanding WSU's presence in the state. Frequently, success can only be achieved by strong central leadership that mandates new directions. At WSU, decisions to upgrade technology on campus, to build three branch campuses, and to establish learning centers were decisions made centrally. One of the ways WSU has responded to these changes is to create learning centers throughout the state that are equipped with computers and phone lines and provide staff to assist students in a location close to their homes.

The role of the college leadership and the faculty senate has been to explore ways to compensate faculty who participate in the programs, to develop the curriculum, and to review all instructional programs prior to their being offered. The result has been some differences among colleges in the speed of adoption of new technologies and an ongoing examination of the structures that have been established. The process hasn't been easy and how to fund new programs continues to be a problem, but nothing would have happened without central leadership.

What have been the results? The short-term effects were frequently dissatisfied faculty who were not prepared for the changes technology required. The long-term result, however, is that WSU is in the forefront of responding to student needs. Wherever they are and whenever they have time, students can select the education models that work for them and that give them the learning they need to function in a knowledge society. It is not unusual for enrolled students to take some courses on campus and other courses through the EDP and still others through flexible enrollment courses—the old correspondence courses that are asynchronous and rapidly changing in the mode of delivery from mail to Internet.

Students are beginning to understand that education is something they *do*, not something that happens to them only when they attend lectures and participate in laboratories. At the same time, many faculty are beginning to seek ways to incorporate technology into their on-campus courses and others are seeking the services of CTLT to learn how to prepare courses for online instruction. Supporting these efforts is state support through the Washington legislature and the Higher Education Coordinating Board for the expansion of technology use and technology-related programs and courses. As the demand for lifelong education increases, universities must respond. Education will be more informal, more accessible, and more learner driven and will need to be available any time and any place. As communities of learning, universities will be central to these efforts but *only* if they are willing to transform themselves.

Students are finding ways to redefine themselves as well, which is yet another change in students' relationship with education. Students enrolled in the programs delivered through the EDP have formed the first student organization that is completely online. These students are as much a part of the Associated Students of WSU, the on-campus student organization, as are the student organizations operating at the branch campuses. They pay student fees, submit budget requests, testify in the state legislative hearings, and participate in commencement—frequently commencement is the first time they have physically been on campus! Even though the *sense of place* may change and the *actual place* may be fluid, the *importance of community* remains.

Expanding Partnerships

Technological changes have modified the relationships among educational institutions, corporations, and government. There is far more necessity to work together to achieve the goals of a new environment. The use of technology has added expense to the academic mission, and the corporate skills honed by years of commitment to the bottom line have provided industry with examples that can be adapted to provide new educational models. Corporations frequently have reason to work with higher education to ensure a workforce with the technological skills and competencies necessary for future employees.

At WSU, faculty are actively involved in a variety of partnerships. Some specific partnerships demonstrate how faculty in different disciplines have partnered with industry. Funded by the Vulcan Corporation, a faculty member in the economics department has created online courses in introductory economics. In the first year, these courses were taught in a combination of on-campus class settings and through the Internet. During the second year, the courses were taught on the Internet with the faculty member in the role of the guide as the students moved through the material. The course is now available for use at other institutions and is being marketed by WSU. The faculty member, an "early adopter," now serves in an advisory capacity for other faculty.

Major corporations in the state continue to place emphasis on continuing education for their employees. WSU has responded to this momentum by offering an array of programs for Boeing in Seattle and at other Boeing sites. Such programs are delivered by faculty on-site as well as through technology such as video and the Internet. Both WSU faculty and managers from within the corporation share in making decisions about what courses and programs will be offered. Such new approaches are not easy. Faculty on campus must understand corporate needs and be responsive to them. Corporations are placed in a position that requires longer time lines than they would want for the approval of courses and programs. Initially the WSU programs were primarily in engineering, but Boeing is now seeking more integration of business courses within the curriculum. These instructional programs mirror the philosophy Boeing has incorporated into its leadership center in St. Louis, where Boeing employees participate in cross-area educational experiences in two-week immersion seminars to learn teamwork as well as corporate priorities. The university's CTLT is supporting faculty in transforming these courses to Web-based courses to provide more flexibility for Boeing students.

Although many faculty genuinely want to participate in new ways of teaching, some of them remain frightened, unsure, or even unwilling to do so. Faculty may look to support from their colleagues initially, but long-term support must be institutionalized. Many universities have responded by setting up centers for teaching and learning, technology centers, training centers, and the like to educate faculty, but participation takes time to develop and funds to support new ideas are scarce. Costs are high, and the universities need to develop strategies to ensure a revenue stream to support innovation and development. Working with industry can stimulate the development of technologically enhanced courses and can also bring new ideas into the academic environment. Partnerships between universities and corporations can result in new courses that can be offered through the corporation or other venues. Most universities are not experienced at the packaging and delivery of courses, and industry has already tested several models. Increasingly, the needs are not for complete programs or courses, but rather for modules that are interchangeable to meet workforce needs or competency-based examinations to respond to requirements for particular skills.

The future for quality education will include an emphasis on industry partnering with institutions, with faculty, and with students. Frequently these partnerships will not necessarily be based on technology but rather will be creative programs that seek to establish long-term relationships and to integrate university and corporate cultures. For example, working with Boeing, WSU has established a program called "Boeing Scholars." This program has several mutually beneficial objectives—providing scholarship support for outstanding students in engineering, business, and science; creating workers for Boeing who are trained to work collaboratively; and bringing a more diverse workforce to Boeing. Students are identified at the end of their sophomore year, whether they are in a four-year WSU program or are applicants from a community college to one of WSU's four campuses, three of which only offer upper-division courses. During their junior year, these students receive a Boeing scholarship. If the students maintain at least a 3.0 grade point average, they will have the opportunity to participate in a paid internship at Boeing during the summer between their junior and senior years. During their senior year, they will again receive a Boeing scholarship and will be required to register for a cross-disciplinary capstone course that brings the Boeing Scholars together to work on a collaborative project. In most cases, Boeing will provide the topic or issue for the project. These students will work in teams using technology to communicate and develop their projects. It is expected that many of these students will be offered positions with Boeing. This partnering approach to learning is consistent with Boeing's model that integrates employee skills, provides lifelong learning, and uses technology to do both. All of this will bring new experiences to students as well

Students are beginning to understand that education is something they *do*, not something that happens to them.

as recognition of their scholarship. The interactions will also strengthen the relationship between Boeing and the university.

The Future

Some institutions will survive because they are willing to change; others will fill niches for particular students or interests while others will simply disappear. It will be some time before students will all expect to attend college by accessing courses over the Internet from their bedrooms. The desire to leave home will continue to be a motivator for some students, and disciplines that require laboratory or clinical experience will require that students attend a central facility. At the same time, corporations will continue to encourage on-site education and flexible ways to expand employees' educational opportunities. The tripartite mission in higher education of research, teaching, and service remains critical to the future of the nation and cannot be replaced by quick fixes and short courses. The goal of the university is to produce an educated citizenry and a skilled workforce, but it must increasingly do so by being accessible and flexible. University administrators must recognize that multiple modes of delivery within flexible time periods will be necessary to meet the needs of the student of the future.

One of the ways higher education can ensure that its values and its content will continue to serve students is to become an integral part of the changing environment. Knowledge and learning have become the core of a competitive industry. Most faculty and administrators in higher education continue to believe that traditional faculty in established institutions are critical to creating the next generation of knowledge workers, yet frequently they do not know how to accomplish this task. Change can occur while continuity of quality learning continues if there is recognition that the partnerships bring together faculty who have a knowledge base and corporations skilled in delivery mechanisms, both committed to achieving quality in the emerging distance education industry.

Too frequently, universities imagine that they are separate from the corporate and political worlds; clearly, they are not. They manage huge and complicated accounts, but they do not necessarily describe themselves as corporations. Colleges and universities provide utilities, but they are not utility businesses. They cooperate with local governments to underwrite transportation systems, but they are not cities. Thousands of employees are processed through their human resource offices, but there is a deeply ingrained insistence that these employees are all part of a "family" and not simply numbers in a database. The perception higher education has of itself is in direct contrast to a marketing strategy that speaks to the bottom line, profit margins, or even downsizing. Yet, universities *do* want to be more efficient, if for no other reason than that legislatures and governing boards are demanding it. Corporations must be a part of the educational process that will transform the way colleges and universities manage information in the next century.

But partnerships cannot just be between corporations and institutions of higher education. Key higher education organizations are already poised for partnerships. NASULGC (National Association of State Universities and Land-Grant Colleges) is in the process of publishing a series of studies on universities, examining access as well as the engagement of universities with their communities and their students. This association of land-grant and public universities and colleges is committed to ensuring that institutions transform themselves to meet the needs of a changing student body as well as a changing educational process.

WICHE (Western Interstate Commission for Higher Education) is very interested in distance learning and how new methods of delivery can be responsive to the increasing imbalance in college-age populations in the West. WICHE also provides an opportunity to interact with policy makers and legislators to influence some of the policies that challenge education: tuition policies for out-of-state students accessing distance education courses, state ethics board policies about electronic publishing, patent and copyright policies, and requirements for multiple signatures instead of electronic processing for purchasing.

These new models directly confront existing intellectual property and copyright issues. One of the biggest problems and a vexing issue for higher education created by the changes in the delivery of education is the issue of ownership. Corporations and national laboratories assume that all intellectual property belongs to the employer; however, universities have traditionally accorded intellectual property rights to the inventor or, in some cases, have provided new knowledge without any expectation of monetary gain. Now most large universities have faculty creating Web-based courses, video courses, and distance learning courses that combine a number of media. Every university is struggling with how to reward faculty for the content and still have the funds necessary to pay for the development costs. What happens when a course needs to be updated and the faculty member has moved to another school? How are profits shared if a course is marketed through the multiuniversity consortium called Western Governors University or if faculty at multiple institutions created the course? What if the course used resources provided by a national laboratory? What if the course was developed at home rather than in the faculty member's office? Although most institutions are grappling with these issues, few have found definitive answers.

Higher education can ensure that its values and content will continue to serve students by becoming an integral part of the changing environment.

Educational institutions have much to learn from corporate business practices, but corporations and businesses interested in the development of distance learning and other educational uses of the Internet and technology also need to better understand assessment and evaluation of courses, student learning styles, and the faculty role as guide and mentor in the educational process. These partnerships require that both industrial and academic leaders learn to better understand the "cultural" differences of their very different entities. Frequently traditional faculty reject the corporate business model, making corporate leaders doubt that change will ever occur. Sometimes academic leadership has moved too quickly, eager to support change before the faculty are ready or the systems are in place. On most campuses faculty acceptance—even enthusiasm—for using new learning technologies is beginning to emerge. A few years ago faculty were asking why they should even consider using computers or the Internet as a part of their teaching, and now many of them are seeking ways to redesign their courses using new approaches made possible by technology. Such measured acceptance is probably good in that it guarantees that academic integrity will remain central to educational systems.

As lifelong learning becomes better understood and accepted, additional learning groups will emerge. Already professional societies require continuing education—for doctors, nurses, lawyers, and teachers. Historically such learning has been handled in universities by extended education divisions using variations of traditional classroom learning, but in the future it is likely such courses will be offered electronically as part of the university's mission. Increasingly professional societies, industry, and higher education will jointly develop such courses. The old lines that divided on-campus education and continuing education are blurring.

The implications of change on universities are formidable to some and embraced by others. What is constant is that there *will* be changes in the delivery of education, and there *will* be a shift from teaching to learning and to the integration of academic and administrative systems to ensure the seamlessness of education as students move through K–12 to the university to corporations and to lifelong learning. It is incumbent upon academic leaders to ensure that their institutions have in place the support systems for faculty and students to succeed in the new environments. To do any less is to fail our constituents and our future.

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J. Thomas Bowen

4

Technology's Contributions to Academic Planning

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Introduction and Background

The task presented me was simple: write a chapter about how technology drives academic planning in higher education. It would seem acceptance of this assignment immediately established the presumption that I agree that technology drives academic planning in higher education. As part-time academician and full-time academic administrator for almost 30 years, I resented conceding such proclamations without serious study. However, after much contemplation, I realize that the assertion may indeed be credible. Technology has, in fact, created rapid and profound levels of adaptation in all aspects of society. By all indications, technology has created and will continue to create the most profound changes in higher education since Harvard University established the elective system in 1825.

First, though, here is a brief introduction. Academic planning or an academic plan is the process an institution uses to identify, define, operate, assess, and discern among an array of programs and activities offered to its students and enlivened by its faculty. It is the way in which an institution coalesces and coordinates its resources to accomplish its mission: (1) to teach students to become lifelong learners and skillful career achievers and (2) to create knowledge and apply knowledge to improve life for society in general.

For decades, academic planning has incorporated technology as an integral part of an institution's resource allocation and information management processes. During the nascent technology years, institutions spent large sums to equip and maintain central, mainframe-based computer systems for academic and administrative use. In most cases, the central computer systems supported operations that clearly separated the computer programmer/analyst/specialist from the user. However, the creation of the personal computer in the mid-1980s started a rapid progression toward "distributed data processing," where specialized software enabled the user to independently program specific information needs. Today, continued emphases on distributed data processing through the application of high-level commercial software packages, combined with the expanding capabilities of presentation (i.e., audio- and video-based) technology and the rapid development of the Internet/World Wide Web have made technology the central focus of academic planning in higher education. In fact, some experts argue that technology now drives academic planning in higher education.

The argument goes that technology now has become so ingrained in every facet of the academic enterprise that planning and budgeting for its effects has become paramount and even competitive. For example, institutions now proudly announce full connectivity in residence halls and classrooms as a recruiting strategy for new students.

Many factors, including technology, drive academic planning in higher education today. Which specific driving force will dominate academic planning varies according to an institution's resource profile and mission. Part of my reticence to accept technology as *the primary driving force* in higher education stems from early career experiences with computers, the kind larger than a walk-in refrigerator, slower than a modern-day toaster, and louder than a pickup truck with a broken muffler. I recall the early days of card sorters, when IBM mainframes hummed ceaselessly, when technology was merely a tool to help someone accomplish a task fast and efficiently. The card sorter arranged a mailing list in last name sequence quicker than anyone could sort index cards in a similar arrangement. These early technology tools simply made routine tasks faster, easier, and more efficient and relied on the user to learn the proper operating procedures. Today's technology tools emphasize "user-friendly" applications that result in a much more profound effect of technology on the overall process.

During technology's early years, colleges and universities became the main proponents of and pioneers in many technological advances. The 1980s brought technology to the desktop, with multifunction touch-tone phones, personal computers, and video recorders and players available at an affordable cost. The functional purpose of technology moved from a central information management application to an easy-access, user-friendly presentation and communication tool that has a variety of good teaching applications. Higher education recognized the value of technology as a teaching aid and communication device that can make learning fun, interactive, and exciting. Today, although higher education remains a principal proponent of technology applications, other private sector agencies also lead in technology innovation, causing higher education to become proficient with emerging, unfamiliar technology applications.

Technology's Infusion Into Academic Planning

So, technology has played an important role in the collection and management of central administrative information and individual project research data since the 1960s. During the 1990s, however, rapid advances in computer and image projection technology opened opportunities to apply technology to the core academic planning process of any college or university—instruction.

Impact on teaching and learning. If the statement that technology drives academic planning holds credence, the point of major impact is instruction. Technology offers immense variety in alternative teaching strategies and learning patterns, and poses challenges to faculty to determine which topics are better learned using which specific format. The development of Internet resources and other such technologies for independent learning offers great opportunities. Some topics suitable for independent learning may never be formally presented in class lecture and discussion; yet, the lessons learned through outside research activities are just as important and valuable to the student's growth and development (Nickols 1999, 1–2).

Advances in presentation technology during the last decade provide faculty with the capability to demonstrate laboratory exercises to a large group of students, adding depth and dimension to what otherwise could be unexciting lectures. In small classes, technology can amplify discussions during class, as an instructor might link via satellite to engage students in real-time conversation with renowned authorities across the world. Technology also enables a professor to conduct extended electronic discussions beyond the classroom with part or all of the class members. Technology also has refined and improved distance education, a concept that has endured for more than four decades. Again, the reality of communicating simultaneously with students in distant locations has brought impressive results in higher education.

Thus, technology can increase student-faculty interaction, improve the quality of in-class presentations, and increase alternatives for more students to enroll. But what effect does technology have on actual student learning? It enhances the student's ability to learn when it matches the mode of presentation with the student's aptitude for and interest in technology. College students of traditional age (18 to 24 years) have grown up in such a technologically sophisticated world that they routinely expect college faculty to apply similar technology to their teaching strategies. In this sense, technology increases student demands and expectations of faculty.

When students demand more from faculty, faculty will demand more from the institution. Who should train faculty to use technology and who should help them develop multimedia materials for instruction? Many new young faculty already prepare their instructional materials using multimedia technology. And as veteran faculty begin to use multimedia technology to present classroom materials, post course syllabi and reading materials on the Internet, and connect to satellite programming, increasing numbers of faculty who use technology in the classroom will raise demand for more technology-equipped classrooms.

When students demand more from faculty, faculty will demand more from the institution.

How an institution manages this dual demand of faculty access to technology and to classrooms equipped with technology becomes a central strategy in an institution's academic plan. The methods it selects to distribute and manage technology resources will determine how receptive faculty are to adopting new teaching methods. Both demand issues create a desire for an institution to manage its instructional resources in an equitable manner. Some institutions allocate funds to departments to purchase and install multimedia classroom equipment. Other institutions take a centralized approach, grouping classroom scheduling, supporting, and equipping functions under a central office like the registrar or an instruction support unit. Institutions that have ample instructional space for each department will typically decentralize their technology resources allocations. Conversely, institutions whose departments lack adequate instructional space will centralize resources and services to coordinate and manage efficient use of the scarce resource. When institutions take the decentralized approach, allocating funds and resources to individual departments, the outcome can result in stronger unit ownership and less interdepartmental cooperation in classroom utilization. Departments often view classrooms as an exclusive resource and the installed equipment as an investment they must protect from outsiders, including their colleagues across campus. From an institutional perspective, the result likely will lead to duplication of resources and services throughout campus, as each college or department develops internal strategies to manage its technology resources.

To avoid or at least diminish the issue of territoriality, institutions must view technology and instructional facilities as institutional resources open to and used by all departments and managed, maintained, and supported at the central administration level. Technology within these instructional spaces also must be centrally managed, maintained, and supported with adequate budgets to implement plans for life-cycle funding to replace worn, outdated, or broken equipment on a regular basis.

Another important institutional commitment must be made to provide training and assistance to faculty who want to upgrade their teaching materials and strategies to use technology. Again, if this process is managed as an institutional support service, faculty will recognize and appreciate the value and importance the institution places on instruction. They will feel confident enough to spend time converting old lecture formats to electronic slides and posting course syllabi to the Web when they are confident they have strong institutional support. Thus, institutions must plan carefully for the distribution of funds for technology so that the correct and intended message is conveyed to faculty and students who use it. For more information about classroom design support and technology applications, visit www.classrooms.com/index.html.

Impact on research. As in instruction, technology plays a major role in theoretical and applied research activities conducted on college and university campuses today. In addition to improved information collection and dissemination, technology has enhanced the performance of academic research facilities and equipment, and has created communications capabilities unsurpassed in our lifetime.

Although some have argued legitimately that information placed on the Web lacks proper screening for accuracy, relevance, and authorship, no one disputes the value and importance of technology in providing access to information. In fact, in many ways technology has increased the accuracy, quantity, and quality of information available to researchers today. True, Internet searches must be scrutinized carefully for veracity and accuracy, but this technology that provides instant access to libraries, catalogs, and records throughout the world has forever changed how academic research is conducted.

Moreover, technology has improved scientific procedures used in laboratories beyond the capabilities of human performance. Equipment on laboratory benches today performs tasks, in minutes and with perfect accuracy, that humans did a few years ago in days with not so perfect accuracy. A good example is the blood-typing machines used in biomedical laboratories that can perform more extensive tests with greater accuracy in less time than human technicians could ever do.

Whole venues of research activity currently operate via e-mail and electronic communication. Medical procedures now routinely take place using teleconferencing technology so that one distant surgeon can guide the techniques of a practicing surgeon during an operation. Increasing needs for rapid access to research discoveries and speedy dissemination of research results now cause some researchers in disciplines such as physics and astronomy to publish their results on the Web and pass over traditional print media either initially or altogether.

While technology has become a great enabler for college and university researchers, it also has become a bargaining pawn in the chess game of faculty recruitment. Research institutions compete fiercely with one another to bring prominent researchers (and their grant revenues) to an institution. As part of the institution's negotiations with a faculty researcher, substantial amounts of start-up funds are commonly committed to purchase the latest technology and equipment for the researcher's laboratory or workplace. Research on college and university campuses today demands a modern technology infrastructure that will attract and support faculty research efforts. Successful faculty recruitment, however, also requires not only the latest in equipment technology but well-designed and modernly equipped laboratories, wired for high-speed communications and suitable for graduate and undergraduate student assistants, in addition to the primary researchers, to work in.

Impact on service and outreach. Whether for public or private institutions, technology also plays a major role in the third mission of many institutions, community outreach and public service. Distance learning technology has expanded an institution's instructional programs beyond all physical boundaries, providing learners (not just students) with "anytime-anyplace" learning opportunities, both for college credit and for personal growth and enlightenment.

Teleconferencing and the Internet provide venues for communities to utilize the resources of geographically remote colleges and universities without the expense and inconvenience of frequent travel. These technologies provide small, remote communities access to resources they could not obtain otherwise. For example, staff in the University of Georgia's Information Technology Outreach Services office surveyed and mapped county boundaries and utilities infrastructure across the state of Georgia. The data provided to state and county officials help counties plan growth and economic development activities using a full array of existing and potential resources in a specific area. They provide topographical data related to environmentally protected wetlands, land contours, and other features, which aids local governments in their management responsibilities.

The creation, categorization, acculturation, and presentation of knowledge are the essence of academic planning in higher education today.

Thus, technology plays a major role in the way colleges and universities carry out their missions of teaching, research, and service. But what impact has technology had on student learning, arguably the most important goal of higher education?

Impact on curriculum. New courses of study and new skills and tools are required for students as a result of technology's impact on what and how the typical student learns today. A review of the curriculum indicates most colleges emphasize that all students learn basic computer skills. Though some courses teach specific software applications, such as Microsoft Excel or PowerPoint, colleges assume students will develop additional, specific computer skills appropriate for their profession once they become employed. General-skills computer courses focus on a broad fundamental knowledge of information technology that can be applied to any profession, such as Internet applications and using computers for presentations. Specific software and programming applications usually are offered to upperclassmen who want training for specific career development.

As generations of new students arrive on campus, the percentage of students already possessing fundamental computer and technology skills increases. Many students today thrive on learning activities available electronically through interactive learning communities, chat rooms, and threaded discussions on the Web. This reality challenges colleges and universities to regularly upgrade the technology requirements they expect every student to master upon graduation. Conversely, faculty must continue to upgrade their computer technology skills to keep pace with their students.

Impact on institutional management and planning. If information technology has created such a significant impact, an equivalent impact has occurred on the management, operation, and planning functions of the institution. Since academic planning prescribes how an institution will make decisions about resource allocation, it must figure centrally into an institution's management and planning process. In fact, the impact of technology on institutional management may be greater in number and variety than any other aspect of higher education.

Technology also has created a need for a more clearly delineated organization structure to support technology. Today, most institutions have established offices and, in some cases, specific individuals (e.g., chief information officer or the vice president for information technology) who make decisions regarding technology and information resources for the college. Responsibilities often include final authorization of all technology equipment purchases, oversight of the campus communications network infrastructure, management and maintenance support for student computer laboratories or student-owned laptop policies, and development of a budget framework for information technology applications across campus.

Earlier, a historical review described how technology moved information management from a centralized, mainframe operation to a decentralized, distributed processing operation. Now, each department can conduct its own analyses and maintain its own databases. Although this offers many benefits and advantages, such as quick response and localized priority setting, decentralization can create havoc in reporting consistent and accurate institutional information to the central administration and to external agencies such as national granting agencies and foundations.

The use of technology in all aspects of institutional operations dictates that the institution must have the proper organizational structure in place to support these functions. At many institutions, committees composed of faculty, staff, and students make recommendations to administrative executives on funding priorities of technology resources, policies governing the use of technology resources on campus, and future directions of campus information technology growth.

Moreover, an institution's organizational structure must support faculty efforts to incorporate technology into their instructional materials and strategies. From a technological perspective, most institutions face a division of faculty needs and capabilities in user technology. Many faculty who recently entered academe already possess basic skills in the use of computers and classroom presentation technology; they only need access to classrooms that are fully equipped with technology and some assistance in keeping abreast with the latest enhancements in technology. Established, entrenched faculty may not have developed either computer or presentation technology skills yet; they need assistance designing and developing course materials and learning how to use the presentation technology that exists in the classrooms. The institution must provide the instructional support structure to make all faculty feel comfortable and confident to use presentation technology in instruction.

Instructional support offices at Virginia Polytechnic Institute and State University and the University of Georgia are two examples of how institutional support encourages faculty to use technology in instruction. Virginia Tech's initiatives are described in chapter 11. Both institutions have established programs that assist faculty in all aspects of technology applications.

At the University of Georgia, the Office of Instructional Support & Development (OISD) (www.isd.uga.edu) collaborates with University Computing and Networking Services (UCNS) to support technology-enhanced learning environments throughout campus. Faculty can receive grant awards to develop new instructional strategies using technology. University faculty adopted WebCT courseware early and became one of the world's largest WebCT users, applying it to nearly 500 courses and thousands of students. More than 100 classrooms equipped with a variety of technology packages support the faculty who teach these Web-enhanced courses. Additionally, students can access online course materials from residence halls, open computer laboratories across campus, or their apartments off campus. Faculty receive personal assistance from OISD staff to learn how to use the technology in the classroom and how to apply technology to enhance their curriculum materials and teaching strategies. Both offices operate on the premise of creating a seamless environment of technology support for faculty and students.

Higher education must change, and its foundation of academic planning must adapt to new social forces.

No matter what technology expertise they possess, faculty will use classroom presentation technology only if/when they feel confident to conduct their presentations without fear of equipment malfunction. When equipment malfunctions occur, faculty must feel confident they can contact someone who will arrive quickly to help them so that critical class time is not lost. These assurances become especially important when faculty teach away from their home department in classrooms scattered across campus.

A variety of management approaches can provide this level of support to faculty. Most important is the philosophy and message conveyed that the institution values instruction and faculty efforts to improve their instruction quality. Institutional support for the use of technology in instruction must cover three primary functions:

- Classroom technology equipment operation and maintenance, including a life-cycle funding for regular replacement and upgrade of equipment
- Faculty training in the use of classroom presentation equipment and computer software
- Faculty technical assistance in the design of electronic teaching materials for classroom instruction

Institutions also may consider awarding faculty release time, via sabbaticals or grants, to prepare and develop electronic course materials and to improve or refine their presentation skills.

As explained earlier, technology affects the management of an institution in more ways than instruction. Spurred by advances in technology, research programs have progressed rapidly because data can be analyzed more thoroughly, uncovering relationships previously undetected. The result is that research activity and funding now cross the boundaries of specific disciplines and promote interdisciplinary collaboration more than ever. For an institution, the department traditionally has formed the foundation of the academic enterprise, but technology contributes significantly to integration (some argue, dissolution) of the core discipline boundaries in academe. Consider, for example, the integration of research activities conducted in biological and life sciences, veterinary medicine, pharmacy, and environmental health sciences.

Knowledge-driven higher education. So if technology is the main influence of such changes in higher education, why is it not the main driver? Because technology is the primary tool to transform higher education today, much like the laser has transformed medical surgery. James Duderstadt (1998, 5) describes technology as the agent that creates change in "knowledge-driven organizations." Thus, innovations in knowledge—fueled by technology—drive changes in academic planning and higher education on a broader scale. Colleges and universities, the purveyors of knowledge, must use technology to harness knowledge to create what Duderstadt called "a culture of learning."

The creation, categorization, acculturation, and presentation of knowledge are the essence of academic planning in higher education today. Technology gives academicians the best mechanisms to create, construct, and convey this knowledge to society. Higher education is by no means the sole generator or custodian of knowledge, but colleges and universities do serve society, according to Duderstadt, as "knowledge servers."

Thus, technology drives the knowledge bases headquartered in colleges and universities around the world. However, increasing competition from industry and other private sector economies and growing demand for alternative forms of education make this role uncertain and threatened. Yet, demand for higher education continues to increase as next-generation students move from high schools into colleges. Technology has enabled rapid growth in what Duderstadt calls "an open-learning marketplace" to the point where higher education must adapt quickly and profoundly to change, a role uncharacteristic to a profession that still conducts business much as it has for centuries.

Higher education must change, and its foundation of academic planning must adapt to new social forces. Duderstadt recognized that technology has released higher education from the bounds of space and time and has created conditions favorable to the creation of a "ubiquitous learning" environment, where people constantly learn throughout their lives, through a variety of venues and learning experiences.

In 1825, Harvard University changed higher education forever by adopting the elective system, a set of curricular offerings that provided students with choices of subjects to learn. Today technology offers students similar options of how and when to learn. It has opened new venues and avenues for higher education for students to choose content and delivery.

Technology serves the important role as catalyst in this dynamic equation of change, as it supports and serves the knowledge industry. Technology offers immense opportunities for higher education to strengthen an already rich bond between student and teacher, but it cannot substitute for the meaningful dialogue between student and instructor. It must supplement, not supplant, both learning and interaction. Technology's contributions to academic planning will continue to shape the future for higher education.

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Part 2

Implementing the Vision: Principles, Strategies, and Curricula

In chapters 1 and 2, we looked at the strategic importance of building a vision informed by a societal and educational industry perspective. This is a perspective of our campuses from the larger enterprise view, beyond the campus and beyond higher education. It is a perspective that builds on a fresh look at how the campus fits into the larger framework of society. In chapter 3, we glimpsed some possible scenarios that might emerge from a transformational planning perspective. And in chapter 4, we looked at the challenges of integrating technology while keeping our processes and products fairly constant as we plan for the larger transformational initiatives.

From those broad perspectives, we now zoom into the concept of change at a more focused and probably more familiar level—the life cycling of the campus and the curriculum. At the institutional level, planning with technology in mind pushes us into creating a vision that is consistent with an institution's renewed or reinterpreted mission. To be effective in supporting planning, the reinterpreted mission incorporates the impacts of the technology tools on our students and, by a ripple effect, on society's expectations of our higher education institutions.

At the curriculum level, planning with technology in mind drives us to examine how often and when a curriculum may need to be cycled. We want to think about how to answer the questions "When is a curriculum no longer needed?" and "When must we change our teaching methodology and instructional goals for a course, or curriculum, given the emergence of new knowledge and new tools?" These questions can no longer be ignored, as today's portable and flexible communication and computing tools are not only changing teaching and learning, but affecting every facet of our daily lives and every interaction of individuals with institutions.

This book is about technology-driven planning and the principle of incorporating the concept of life cycling into all elements of institutional planning. This principle requires that we plan for the life cycling of our physical tools and buildings, and for the life cycling of the systems and services of the institutions. This includes the infrastructure, the people, the curriculum, the students, the teaching and learning resources, and the transactional processes. Life-cycle planning also embodies the concept of context. We not only must plan for all elements of an institution, but for an institution within the context of time. David G. Brown of Wake Forest University makes this point in chapter 5, "Academic Planning and Technology." He comments that "[i]t is unlikely that any two institutions would emphasize exactly the same principles or that the principles important for Wake Forest in 1999 will be the university's most important principles in 2001."

Many of us have acquired a set of basic principles for technology planning, several of which come from our experiences with owning a car. Cars require maintenance, such as new tires and tune-ups; need upgrades, such as stereos and carpets; must be replaced on a regular basis; and, for those who must have the latest and the greatest, require CD/DVD players, cell phones, and televisions.

The major difference with computers is that everything becomes obsolete at lightening speed, in accordance with Moore's Law. So one basic technology principle is fundamental and occasionally discouraging. While we need to plan for tomorrow's technology while buying and implementing today's, technology is often obsolete by the time we have it set up and in use. Therefore, we have developed these somewhat tongue-in-cheek "principles":

- Only buy software with a version number greater than 1.0.
- It is not a question of *whether* your hard drive will crash, but *when* and *where*.
- Replace faculty, staff, and student lab hardware on a staggered basis, and use the "trickle down" principle, matching the needs with the uses. (This often means that the newest technologies go to the innovators and those pushing the envelope.)
- Do major upgrades over the summer; the unforeseen always happens.
- It always takes longer—whatever "longer" might be.
- It always costs more.

The authors in Part 2 provide guiding principles at a higher level of planning than these implementation principles. Chapters 5 and 6 focus on life cycling at the level of the institution. They provide examples of how institutional missions were modified and updated to reflect a new vision for the institution. In their examples, the revised missions were created from the campus community's vision of the future of their institution. These mission statements reflect a studied community effort that resulted in institutional missions unique for their time, place, history, and students' and society's needs.

Brown provides a link back to the planning practices described in Part 1 with his list of universal concepts for successful academic planning. The first concept in that list is that we must "[m]eander toward a dream." This concept reminds us that the vision, the dream, is primary. The plans that we make are guided by a vision, a dream of what we believe can be. The vision of what technology will enable at the campus level becomes part of the much larger institutional vision for the mission of the institution. Technologies support as well as push transformational initiatives, so we will see technology not necessarily driving planning, but serving as a tool in the campus infrastructure enabling and supporting the institutional vision.

One of the first enabling objectives in the planning visions of the institutions in chapters 5 and 6 was ensuring basic computer access to everyone on campus. In the case of Wake Forest, Brown detailed the processes that resulted in a report completed in January 1995 that contained the recommendation for ubiquitous computing. That report contained the five guiding concepts for their vision. The first of those concepts, "students first," dictated laptop computers rather than desktop computers because laptops provided ubiquitous access to the network from any location that supports access to communication and learning resources. In the case of Valley City State University and Mayville State University and their ubiquitous computing initiatives, author Ellen-Earle Chaffee states in chapter 6, "The Impact of Technology on Institutional Planning," that these initiatives had their origins in "strategic academic plans," with a goal of improving teaching and learning throughout the institution.

The institutions described by the other two authors in Part 2 arrived at almost the same conclusion, but by going down different paths. The action plan for ubiquitous computer access described by John E. Kolb, Gary A. Gabriele, and Sharon Roy at Rensselaer Polytechnic Institute came after substantial curricular change, as they describe in chapter 7, "Cycles in Curriculum Planning." The success of the curricular initiatives depended on placing computers all over campus. Over time, the lower costs and increased capabilities of laptop computers compelled them to that ubiquitous requirement for fall 1999. In the case of The Pennsylvania State University, John T. Harwood states in chapter 8, "Does a College Curriculum Have a Life Cycle?" that the direction of ubiquitous computing is also being compelled by curricular initiatives. However, in this very large land-grant institution, the campuswide requirement for computers is not yet in place. Personal ownership of computers increases annually, however, and access is now at a point where it can be assumed, given the complementary availability of computers on campus. The trend toward ubiquitous computing is nationwide, but appears to be growing slowly. The 1999 Campus Computing Survey by Kenneth C. Green (www.campuscomputing.net) reported that 62 percent of students at public institutions owned computers. However, only 2.7 percent of the institutions responding to the survey required ownership. The number of institutions requiring students in specific disciplines or programs to own computers was 9.1 percent. As the cost of computer ownership decreases, and the options for computing increase, the challenge of ensuring access will decrease.

Change Creation Principles

Brown provides us with a link to chapter 2, which is about change creation. In his section on the "Importance of Shared Ownership," Brown states that "[t]o succeed, changes of this magnitude [ubiquitous computing] require many advocates and the building of a broad consensus." He continues, suggesting that "successful implementation is more likely when planners pay attention to five topics: the endorsers, forums, stakeholders, boundaries, and rationale." This story may well be an example of a change creation in progress. The advocates and endorsers of Brown's implementation at Wake Forest are the sponsors of the change creation principles advocated in chapter 2. The forums are a mechanism for the necessary broad communication, dissemination, and consensus. These same themes of sponsorship, advocacy, and communication are echoed throughout the stories of the implementations described in chapter 6 and the curricular initiatives described in chapters 7 and 8.

The change creation principles were clearly at work at Valley City State University and Mayville State University. Both of these universities launched significant initiatives—but only after broad campus involvement in the decision-making process. As part of the change process, campus leaders worked with a technology planning committee (TPC) on the difficult task of budgeting for this change. In a remarkable example of trust, each TPC "had control of nearly all university equipment funds for the first few years and continues to control a majority of those funds." Even with this budgeting approach in place, the cost to students was a significant increase over past tuition, with a $950 annual technology fee. Subsequent surveys support this effort, with 90 percent of students saying that technologies enhance learning. The principles of change creation are clearly at work here, with high-level sponsorship, over time, and with broad campuswide communication, planning, and shared vision.

Brown also reminds us of the principles of sound planning, that we need to plan with key variables in mind—the point in time, the place where we are, the context, and the technology tools that are available. Brown believes that the real innovations are not expressly in the technology, but in what the technology enables us to implement at the point of teaching, in other words, in the teaching methodology. The teaching and learning infrastructure needs reflect the types of support required by the new technology-enabled teaching methodology. Thus, innovation in teaching and learning is an ongoing, continuous, interactive process. New tools enable new methodology, new learning, and new content.

The interaction between the technology and the teaching methodology is also described in chapter 7. The authors of this chapter identify three forces that they believe push us into the work of life cycling our curricular programs: (1) new knowledge in the discipline, (2) new knowledge about how we learn, which translates into new teaching methodologies, and (3) new tools for learning, which translates into the new tools provided by IT advances. The development of discipline knowledge continues at a rapid pace; new knowledge from cognitive science about learning is resulting in new recommendations about teaching methodologies; and IT advances, developing according to Moore's Law for more than 30 years, show no real signs of abating. (Scientists are definitely worrying about the ability of Moore's Law to continue, but they have worried before.) Given these forces, it is highly probable that the push for curricular reform and life cycling will accelerate even further.

The new technologies have entered the curriculum in new ways at Rensselaer and Penn State. At Rensselaer, the first wave of curricular reform was initiated based on the use of a symbolic algebra tool. That initiative was quickly followed by a strategy of vertical integration of computing tools into the curriculum through identification of a set of strategic application tools essential to students' ability to learn and do their intended engineering practice. A set of core, intermediate, and advanced skills was identified and implemented throughout the School of Engineering curriculum. This provided for a progression of computing skills, from basic use of a tool such as a spreadsheet to using the application in complex scenarios. A later initiative resulted in the development of a bachelor's degree in IT to meet the meet for IT professionals "who can broadly apply information technology to world problems." This bachelor's degree was special because it also required the student to include a number of credits in a second discipline.

At Penn State the need for IT professionals and for a focus of study in the areas of both the technology and the interface of IT and its applications has resulted in the development of a new college focusing on the new technologies—the School of Information Sciences and Technology. This new college was designed from its start to be committed to continuous curricular development. Because the focus of this new college will be information technologies and their role and function and interface, the continuous approach to curricular development is almost required by virtue of the anticipated new discipline knowledge that will be driving it.

The continuous curricular development of the new college is in almost direct contrast with the earlier curricular initiatives at Penn State—those of the English and language initiatives. These earlier curricular initiatives highlight the need for life cycling in terms of teaching methodology and tools but also are interesting because life cycling does not necessarily include the goals and objectives of a curriculum. In fact, Harwood makes it clear that the goals for a writing course and language courses have remained constant since 1982. Because the goal of the writing course is "writing persuasive arguments about significant issues in the social sciences," it is clear that the writers of that course were inspired themselves and identified skills that are constant over space and time. Yet as Harwood describes in some detail, the tools and the methodologies have undergone significant change.

One aspect of planning and life cycling that we have mentioned, but not yet dwelt upon, is the need for the life cycling of faculty and staff. By this we do not mean that the old faculty and staff go away, and new ones are brought in. Rather, the life cycling of faculty and staff means a renewed consideration of their professional development. All the campuswide change and curricular initiatives described in Part 2 contain subinitiatives on updating the skills and perspectives of academic leaders, faculty, and staff who are involved in these life-cycling efforts. Faculty are responsible for the curriculum and the guidance of student learning. Faculty development programs such as those described in chapters 6 and 8 are an essential part of the planning and change processes. Academic leaders who have not had to incorporate lifelong learning and professional development across their institutions for these groups must now create opportunities and provide support for required skills competencies. This recommendation is reinforced by the principle of change creation—that learning precedes change.

The examples of life cycling of institutional mission and curriculum in Part 2 share the important characteristics of being responsive to students and to the needs of the immediate and broader society that they support. Enjoy these stories.

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David G. Brown

5

Academic Planning and Technology

David G. Brown, a vice president at Wake Forest University, is also a professor of economics and dean of the International Center for Computer Enhanced Learning. He has served as president of Transylvania University; chancellor of the University of North Carolina at Asheville; and provost at Wake Forest, Miami University, and Drake University. An active user of technology in his classroom, he has been recognized as an "inspirational teacher of undergraduates" by the University of North Carolina at Chapel Hill.

My experiences in five universities, including provostships and presidencies in both the private and public sectors, convince me that the basic tenets of sound planning transcend most subdivisions of higher education. Funding sources differ. Subtle differences in objectives exist. Institutions differ in governance structures, heritage, and self-confidence. Beyond these differences, however, is a short set of universal concepts that is wisely honored by successful academic leaders in all environments.

After defining these universal concepts in the context of a small, public, nonresidential university that serves a high percentage of older students, this chapter details how these same concepts are relevant to the planning issue of the decade—technology—in a major research university. The chapter concludes by sharing some lessons learned about planning for technological change.

Universal Concepts for Successful Academic Planning

Twelve years ago, while chancellor at the University of North Carolina at Asheville, I wrote about the procedural concepts behind UNCA's strategic planning methodology, which are as follows:

- *Meander toward a dream.* The path to the dream is not a straight line without misadventures; rather, it is always "under construction" as it winds in the general direction specified by the strategic plan.
- *Build on strengths.* By first being made stronger, the strong will be able to strengthen the weak.
- *Pursue the comparative advantage.* Distinctive programs, ones that represent a marketable difference, should be emphasized.
- *Ensure broad ownership of the vision.* No constituency can act alone; many hold the power to stall and veto an action.
- *Aim high.* Select a few programmatic areas in which national and international acclaim is attainable.
- *Maintain integrity with basic educational convictions.* Embedded in the heritage of every college is a fundamental set of education convictions, of momentums, that should be followed.[1]

During my tenure at UNCA, most of the university's 2,000 students came from western North Carolina. Less than 10 percent of these students lived on campus, and the average student age was 27 (the highest in the North Carolina system). At the time, two regional public universities (UNCA and Western Carolina University) were on a collision course, both seeking to become the regional university of North Carolina's western mountains. Recognizing the folly of redundancy, UNCA directed its attention toward becoming a nationally recognized public liberal arts university. From the UNCA planning process emerged a funding plan designed around 10 widely endorsed guiding concepts:

- Concentrate on undergraduate education.
- Maintain a large and stable set of core courses.
- Focus effort on teaching and service.
- Challenge students through exposure to new ideas.
- Establish national prominence in selected specialty areas.
- Grow the student head count to 5,000.
- Draw students from the entire state.
- Use resources in the central business district.
- Serve Asheville and its environs.
- Provide logistical support to affiliated educational programs that are not part of the central mission.

Today UNCA has been designated as the state's public undergraduate liberal arts college. It is accommodating the needs of local citizens for graduate education by hosting programs taught by faculty from Western Carolina University as well as six other Board of Governor universities. By very conscious planning, UNCA now provides a distinctive option for students enrolled in the North Carolina system.

In contrast, as provost at Wake Forest University five years ago, I chaired the academic planning effort of a private university with 3,600 undergraduates and 2,000 students seeking advanced degrees in medicine, law, business, and the liberal arts. At Wake Forest, the guiding principles were different from UNCA's principles, emphasizing continuity and institutional momentum. These principles included:

- Continue to personalize and individualize the professor/student relationship.
- Strengthen the freshman-year experience.
- Bolster existing institutional themes and programs before expanding.
- Pursue additional resources.

Wake Forest's "Plan for the Class of 2000"[2] added $15 million to the annual budget and identified 36 specific recommendations, among them:

- Greater course availability
- Required freshman seminars
- Upper-class academic scholarships
- Study-abroad scholarships
- Increased library holdings
- A personal computer for each student

Although the guiding principles and recommendations were tailored to Wake Forest's unique institutional momentum, the procedural concepts at UNCA and Wake Forest were essentially universal. At both the small public liberal arts college and the major research university, the planning processes emphasized sharing the search for the institution's future. They emphasized comparative advantages, heritage themes, existing strengths, and excellence and set high but flexible aspirations. The congruity of procedural concepts applies to all tiers of planning and probably to all types of colleges and universities.

The Wake Forest Technology Plan

Moving from "sleepy valley" to the "third most wired campus in America"[3] in 1999 required consulting broadly, planning boldly, and implementing meticulously. Today, all Wake Forest students and faculty as well as most staff have anytime, anywhere access to their personal computer and the university's campus network.[4] Ethernet wiring is available in every campus bedroom, faculty office, classroom, campus library, laboratory, and many other gathering places, including at Wake Forest's overseas campuses in Venice and London. Identical projection equipment, including super VGA projectors, is standard for 130 classrooms. Sixty percent of the classrooms are wired to each student seat (a percentage that is more than adequate since the primary student use of computers is between classes and not during class). Faculty are provided Internet access from anywhere in the world.

All freshmen receive powerful laptop computers and ink-jet printers. After two years, rising juniors exchange their "freshman" computer for the new "laptop of the year," which they take away with them upon graduation. All faculty and most university staff also receive new laptops every two years. Everyone with a computer in the Wake Forest community, therefore, has one of two models, and every model is loaded with a standard software package.[5] Users with specialized needs (for example, physics majors) download other software packages from the university's network. About one-third of the university's academic departments maintain small, specialized computer laboratories to meet very specific needs.

Wake Forest's library staff provides basic, noncredit computer training to all students and faculty. Each academic department has added a full-time academic computer specialist to assist in using the technology to its fullest. The central computer staff has tripled to more than 60 full-time employees. In addition to supplementary student staffing of the computer help desk, two large corps of students are hired and trained to assist faculty and students with their use of computers in teaching and research. A newly created auxiliary enterprise, the International Center for Computer-Enhanced Learning, trains the staff.

For each student, the Wake Forest system generates a "my.wfu" Web page that links the student to his or her courses, cocurricular activities, and chosen Internet sites. All budgeting, purchasing, and registering activities are online. In sum, one can fairly say that accessible computing is ubiquitous within the university community. Semiannual surveys confirm that both students and faculty value the system and believe that learning is enhanced by it.[6]

Importance of Shared Ownership

To succeed, changes of this magnitude require many advocates and the building of a broad consensus. Especially in matters such as course and curricular design, where individual faculty members are the architects, achieving and communicating consensus is essential not only for approval of the plan but also for its ultimate implementation. Wonderful plans can be sabotaged by lack of funding, agreement, or understanding. Lessons from the Wake Forest experience suggest that successful implementation is more likely when planners pay attention to five topics: the endorsers, forums, the stakeholders, boundaries, and rationale.

The endorsers. Most plans emerge from committees. Many students and faculty will pay more attention to who is on the committee and how he or she was selected than to the recommendations themselves. Generally, elected members are more credible than appointed members. Each stakeholder looks for an "understanding soul" on the committee. Governing boards and cost conservatives applaud the presence of the chief financial officer. Faculties expect a preponderance of membership from their teaching colleagues.

Forums for interaction. Every constituency wants to be heard. Those who study the endorsers also monitor the opportunities for their issues to be aired. If feasible, planning committees should hold two rounds of hearings—the first to solicit ideas and the second to listen to how the committee has initially dealt with the ideas.

Timing is important. It is best when all constituencies have been asked for advice so often that they want to get on with the process. It is preferable when every constituency has been given an extra week or month to input ideas and reactions—tight time lines must be avoided.

They set high but flexible aspirations.

Open invitations are not sufficient. Specific individuals (e.g., department chairs) must be asked to make sure that the views of specific constituencies are aired. It is important that everyone who wishes to be heard is heard. Thus, an all-faculty town meeting and open hearings are important. However, when these forums fail to attract large numbers, more pointed invitations are essential. To say that everyone had an opportunity to participate is not sufficient.

It is also naive to expect that everyone reads interim reports from the planning committee. Interim reports are important but not enough. Deputizing individual members of the committee to introduce the interim thoughts of the committee to familiar constituencies may be necessary.

Hearings and forums are most productive when the testifiers know the focus of committee deliberations, the debates taking place within the committee, and the direction the report is headed. Imitating a procedure followed at both University of Notre Dame and Dartmouth College, Wake Forest's program planning committee published (in newsprint format) a tentative final report and distributed one thousand copies to every constituency. The committee held hearings and open forums and encouraged e-mails. The six months that elapsed between the interim and final reports was viewed by virtually all constituencies as an honest and effective way to solicit opinions from the community at large.

The array of stakeholders. Typically, all stakeholders advocate for "better computing." The devil is in detailing "better computing." Faculty fear they will cede control of their teaching environment to technologists. Librarians fear their interests in print media will be squeezed by commitments to electronic media. Physicists want number-crunching capacity; artists want enormous hard disks for storing high-resolution graphics; social scientists want robust capacities for threaded discussions. Maximum capability with every discipline's international community of scholars is mutually exclusive. Administrators seek limited access to sensitive information while scholars prefer open access, and everyone hopes to avoid learning new programs and transferring existing data to new formats. In short, as the outcomes of a technology plan begin to narrow, each constituency moves away from its "dream conclusion." Resistance and reluctance grow.

In anticipation of this stage, it is important early on to seek formal endorsement of planning principles, such as "standardization of the student platform," "strong support of those forced to migrate," and "annual reevaluation of decisions." Another successful though expensive strategy is to group together (without the possibility of item veto) a full set of recommendations; for example, to add faculty and student study-abroad scholarships and library volumes while simultaneously expanding the commitment to technology. Such bundling can bring reluctant constituencies to vote for the overall plan in order to secure their favored items.

Equally effective is spreading the responsibility for implementing the gains accompanying technology implementation. This broadens the base of advocates and encourages transfers from existing budgets. Instead of adding all personnel under the chief information officer, consider charging the library with computer-training responsibilities (and allocating a new budget committed to that purpose to the library), providing each department with its own computer consultant, challenging deans and department chairs to allocate software funds, asking the bookstore to manage distribution of the computers, or funding a corps of student computer consultants through the residence hall system.

The boundaries of recommendations. The substance of a recommendation will quickly take a backseat to the entity making the recommendation when the strategic planning committee steps beyond its perceived expertise.

At Wake Forest, for example, only five of the 15 committee members were members of the arts and sciences teaching faculty. The committee recommended that a freshman seminar be considered by an appropriate committee composed of undergraduate faculty members and students. The larger committee recognized the limits of its perceived expertise. Similarly, the larger planning committee recommended that a respected group of computer-knowledgeable faculty consider whether to provide every undergraduate with a laptop computer. The larger committee did not attempt to outline a specific program.

Seeking and respecting expertise, especially in those domains where the committee is perceived to be nonrepresentative, is an important trait for technology planners to have.

The rationale. Each university's heritage includes anecdotes, principles, phrases, and "momentum" that are widely recognized as "our university's way." Normally, these themes transcend specific stakeholder groups. It behooves a planning committee to think through how its recommendations relate to these universal themes and university icons. These relationships should be highlighted in the planning committee's report.

At Wake Forest, the planning committee showed how each recommendation would positively affect student learning, which was a key to the acceptance of the overall strategic plan. In the university's technology plan, most recommendations were linked to advancing a more personal and individual, face-to-face learning environment. Whenever possible, it is wise to broaden shared ownership by working from the familiar themes.

Importance of Guiding Principles

Technology planners face a sea of alternatives with degrees of freedom in every direction. Many good and useful things are on the market, too many for any institution to afford them all. Choices must be made. A good strategic plan should focus time, effort, and dollars on the most important institutional objectives. From a set of guiding principles, decision makers throughout the university should be able to infer not only where best to invest dollars but also what not to buy.

For example, the Wake Forest Technology Plan guides decisions by emphasizing five concepts: students first, academic freedom, communication and access,[7] rapid change, and marketable difference. The computing power made available to faculty is driven not by their research needs but by student need. Laptops were chosen because athletes needed access to the main campus network when playing away games, students between terms and those studying abroad wanted to connect to the main network from their homes or host countries, and students working in teams needed the ability to bring their computers to a common site. Students in Wake Forest-owned houses in Venice, Vienna, and London connect directly with the main campus network. Other students connect from off-campus sites by subscribing to an Internet provider. The university provides all faculty with Internet access from off-campus sites and abroad via a commercial Internet service provider.

It is better to implement a modest technology plan than abort one that doesn't reflect predictable constraints.

Upon graduation, students should not be separated from the intellectual tools they have learned to use in college. They should enter graduate schools and first jobs with the self-confidence that comes from familiarity with the computer systems they will most likely be using. Equality of access means anytime, anywhere computer availability for all students, not just those who can afford to buy them.

By highlighting the academic freedom of students, Wake Forest decided to use course management systems that have totally private spaces for every student. All student work is password protected, and the potential for advocate groups to gain direct access to classroom work is minimized. For the faculty, the emphasis on academic freedom shapes faculty development policy. Adoption of technology for teaching is voluntary. Use of the favored hardware and software is encouraged but not mandated.

To maximize the use of the computer to increase communication between students and their professors as well as collaborative learning among students, Wake Forest places a high premium on compatibility of systems, dependability of networks, and universality of access. Those institutions maximizing the capacity of 10 percent of their faculty to make truly wonderful multimedia presentations will invest quite differently. When communication is stressed, threshold standardization becomes essential: everyone should have the same computing configuration to communicate. Specialized needs for nonstandard configurations are met by providing, in some sectors, a second layer of computer access, often in the form of a small computer laboratory in a particular department.

Every technology plan must anticipate obsolescence and the need for refreshment. Equipment acquisition is an annual, not a capital, budget item. Training protocols reflect the need for annual refreshers. Built into the Wake Forest system is constant pressure from the students to update departmental capacity to explore new uses of technology and a reasonable plan for disposing of outdated instrumentation.

By concentrating the gains in computing, the multiple constituencies of the university (faculty, students, parents, trustees, and alumni) can see the gains clearly. Increments of change would have been less visible and change less acceptable. The acquisition of a tangible asset, the computer itself, is now a major factor in both student and faculty recruitment. People will pay for quality. Here there is a marketable difference. This difference is given greater visibility when a partner vendor can be persuaded to feature the college in its promotions.

It is unlikely that any two institutions would emphasize exactly the same principles or that the principles important for Wake Forest in 1999 will be the university's most important principles in 2001. What is constant is the necessity to identify, communicate, and make decisions based on a set of guiding principles.

Importance of Shared Implementation

The willingness of faculty and students to participate conscientiously in the curriculum-planning process is closely related to what happened to the last strategic plan. Did it accumulate dust on the shelf? Or did it drive the budgeting process and university publicity for the next several years? Was the plan implemented?

Since Wake Forest's program planning committee submitted its report in January 1995, the university has implemented 35 of the 36 recommendations. In addition, there has been progress on a faculty salary increase goal, although the objective has not been achieved yet. The entire technology plan is in place. Lessons learned from this experience are likely to have broad application to all types of institutions. These lessons, which are listed below, are factors critical to the successful implementation of plans.

- *Match ambitions and appropriate resources.* Decide on a budget (in time and dollars invested), and then plan. At each stage, ambitions must not overtake realistic possibilities. It is far better to implement a modest technology plan than to abort one that does not reflect predictable constraints. Even at the individual faculty level, it is more important to spread modest technological enhancements throughout a course than to get no farther in designing a multimedia transformation than the third class of a 35-session course.

  Whatever the level of resources committed to technology, approximately 1 percent should be held back to respond to the low-cost special requests (e.g., for a 19-inch monitor) of faculty who will be doubly grateful that their requests are granted.

  Faculty development programs should first ignore the "early adopters" and instead focus on the low-effort/high-benefit uses of technology that can quickly be embraced by 85 percent of the faculty. Once universal use is in place, more time can be devoted to intensive and specialized applications as well as to administrative computing.

- *Professional project management and outsourcing.* The downside of dispersing responsibility for ramping up technology to existing units is the potential absence of coordination. With no one in charge, deadlines will be overlooked. Therefore, hiring a certified professional manager while phasing in enhanced technology is essential.[8]

  During the "ramp-up" period, existing computer-support personnel must somehow balance keeping the current system operating while installing new systems. When faced with specialized and unfamiliar challenges, it is important to set aside the money to outsource work. It is simply not possible to pile the learning of new material on top of program maintenance and system installation.

- *Respect for faculty.* It is neither productive nor accurate to profile faculty, regardless of their age, as antitechnology and antichange. Once they can be assured that students have equal access and reliable technology, most faculty are eager to test the efficacy of new teaching tools. Limited only by their desire not to cheat a cohort of guinea-pig students and their own time, curious faculty—pushed by changing fashions in all disciplines—will quickly push every information systems department to its limit.[9] It will be only a matter of time for the documented emphasis on computer literacy in new hiring criteria to be reflected in tenure and retention decisions.

  The emphasis should be on supporting faculty as they seek to try out technology.[10] Those who try it and find it doesn't work for them should receive the same acclaim as those who try and adopt it. Since disciplines and subdisciplines use technology in very different ways, the administration and the faculty as a whole should avoid mandates such as "all courses must be posted to the Web" or "all classes must have a technology discussion group."

- *Clear and known decision procedures.* If the devil is in the details, the details will be settled largely during the implementation phase. What will be the standard student load? What e-mail system and which network software will be used? At this point, it is important for a faculty committee, preferably an elected one, to decide those matters that impact the learning process directly (e.g., when computers will be switched and what course management system will be adopted). It is equally important for a central force, probably the information systems department, to decide the technological how-tos, such as how best to structure the servers and how to keep them operating without interruption. The division of responsibility needs to be articulated.

  Equally important is communication between users and system maintainers. In an e-mail-driven community, rumors fly very fast and misunderstandings grow quickly. The need for early notification when software systems are to be down for conversion and maintenance or when the system crashes is essential. Computer specialists are not always the best communicators, which means that, occasionally, it is essential to appoint a public relations officer for the information systems division.

- *Pilot and phase-in.* Most campuses have neither the dollars nor the personnel to move in one step from "sleepy valley" to technological adequacy. Full implementation of a plan for technological support usually costs about the same as supporting a library (approximately 5 percent of the education and general budget). Even when both dollars and personnel are available, with most new systems come bugs and glitches that need to be repaired. It is important to shield all but the most eager faculty (perhaps the pilot group) from the frustration of working through the initial shakedown. Widely publicized piloting and phasing are essential to maintain confidence in the value of new systems.
- *Quality first.* Students and their funders will pay for quality, if it can be visible.
- *Shared ownership.* Change, including technologically motivated changes, is most likely to be accepted by constituencies that have had an active role in planning.
- *Leadership.* Passionate, knowledgeable, informed, and widely trusted leaders from the faculty must be supported by capable administrators at the highest levels.

Technology: The New Change Agent

At the millennium, the intersection of academic and technology planning is a crowded crossroad. Technology change is the Trojan horse, the vessel that transports the most influential academic innovations. For most of the 19th century, the way to encourage every faculty member and every discipline to rethink the substance of syllabi and curricula was to change academic calendars, from semesters to quarters to the 4-1-4 to early semesters and back to quarters and semesters. That way of encouraging change is no longer in existence; the nation has, at least for now, settled on the early semester.

Today, the impetus for thoroughly reconsidering everything we do in the university, all aspects of how we teach, search, and discover, is the introduction of a powerful set of new tools that leverage the intellect. Some of these new tools will become standard; others will be left behind. One of the most enduring impacts of this sudden burst of technology is the ubiquitous necessity to rethink every aspect of university life.

Improving interactivity. When 93 professors teaching computer-enhanced courses in 36 of America's most wired campuses were asked why they were changing from traditional to computer-enhanced teaching methods, 91 responded that they sought to provide more interactive learning experiences.[11] They wanted to give students greater access to technology, to each other, to other cultures, and to professionals in the field. They wanted students to help each other learn collaboratively as well as teach each other.

In an e-mail-driven community, rumors fly very fast and misunderstandings grow quickly.

The return of apprenticeships. The real revolution is not one of technology but one of teaching methodology. Technological changes are allowing the teaching in all universities and colleges to be more interactive, more customized, and more collaborative. In the academic arena, strategic planning for technology is directed toward enabling more interactive teaching/learning environments. In one sense, our profession is returning to the apprenticeship model, where a master personally guides the individual development of a corps of apprentices who learn as much from each other as they do from their mentor.

Communication. In the academic arena, the high-impact changes from technology relate to the way in which learners communicate. Not much has changed within the classroom itself. The big shift is in what happens between classes, before the class meets for the first time, and among class members after the final exam. More people from greater distances are available to students. Teaming on projects is easier. Feedback loops are shorter. Information is shared more widely, even as more customized exchanges occur.

Planning for academic changes enabled by technological advances is planning for changes in the style, frequency, and usefulness of person-to-person dialogue. The new paradigm is 24-hour, 7-day-a-week, multiyear possibilities for interactive exchange.

The hidden need for support. Invariably, technology plans focus first on the instruments that are to be made available to students (i.e., the laptop or desktop). Laptops are important. The real challenge and, in many ways, the biggest cost are in the servers that house large databases, the networks that connect the computers, the electrical supplies that power the computers, the time faculty needs to update their methods, and the computer support personnel. Sound technology planning must incorporate all of these components if there are to be any learning gains.

Local confidence in the system. At Wake Forest, the apex of strategic academic planning was its Program Planning Committee and the committee's subsequent report. This was the third Program Planning Committee report in the decade. The community at large feels accustomed to these reports and sees them as considered, important, and influential. It is possible that another structure, perhaps an ad hoc planning task force or "the way it's done at xyz university," might yield a wiser report, but it is unlikely that a less familiar, less authenticated process would yield as many results.

In consensual communities such as universities, where top-down mandates do not work, the best structure for planning is the structure in which the locals have the greatest confidence. The lessons learned at Wake Forest should be thought of as starters, not cookie-cutter solutions, for other institutions.

Notes

[1] These concepts are elaborated in David G. Brown, "The University of North Carolina at Asheville," in *Successful Strategic Planning: Case Studies*, ed. Douglas W. Steeples (San Francisco: Jossey-Bass, 1988), 23–32.

[2] The report is at www.wfu.edu/Academic-departments/Program-Planning-Committee/Plan-for-the-Class-of-2000.html.

[3] Bernstein, R. 1999. America's 100 Most Wired Colleges. *Yahoo! Internet Life* (5) 5: 87–91. Site accessed May 4, 2000 (www.zdnet.com/yil/content/college/colleges99.html).

[4] See David G. Brown, ed., *Electronically Enhanced Education: A Case Study of Wake Forest University* (Winston-Salem, N.C.: Scientific Division of the Wake Forest University Press, 1999).

[5] A detailed description of the computer technology at Wake Forest is available at www.wfu.edu/technology/index.html and www.wfu.edu/~yipcw/WFUcmp98/.

[6] See a full description of the assessment methodologies and results at www.wfu.edu/Administrative-offices/Institutional-Research/AIRpaper51799-handout.html.

[7] For a fuller explanation of this rationale, see David G. Brown, *Always in Touch* (Winston-Salem, N.C: Scientific Division of the Wake Forest University Press, 1999).

[8] See www.pmi.org/certification/ for additional information about certified professional managers.

[9] For a description of how 143 professors in 36 universities are using computers in their own classes, see David G. Brown, ed., *Interactive Learning: Vignettes From America's Most Wired Campuses* (Bolton, M.A.: Anker Publishing Company, 2000).

[10] For a fuller analysis of faculty development policy, see David G. Brown and Elson S. Floyd, "Best Practices in Faculty Development," *Multiversity* (winter 1998–99). This article can be found at www.hied.ibm.com/multiversity/Win99/bestpractice.html.

[11] Brown, David G., ed. 2000. *Interactive Learning: Vignettes from America's Most Wired Campuses*. Bolton, MA: Anker Publishing.

Ellen-Earle Chaffee

6

The Impact of Technology on Institutional Planning

Ellen-Earle Chaffee is president of Mayville State University and Valley City State University, among the first to provide notebook computers to all students. She earned her Ph.D. and M.A. at Stanford University, her M.S. at North Dakota State University, and her B.A. at the University of Kentucky. She was president of the Association for Institutional Research and the Association for the Study of Higher Education and has written five books and many articles on strategic management, quality, and leadership.

Planning for technology on campus is undeniably important, as it is for any complex, expensive set of decisions. Yet "few higher education institutions are making concrete plans to link investments in information technology to their desire to attain strategic academic goals" (Twigg 1999). If true, this statement is disturbing for at least two reasons. First and foremost, strategic academic goals should drive technology decisions, not follow them. The higher education institution that places technology ahead of or apart from its primary mission of teaching and learning is imperiled. Second, changes in technology have far-reaching effects throughout the institution. If those changes are not guided by the strategic academic plan, the institution risks failing to realize the full benefits of its technology investment. This chapter describes how two small universities are using technology for their strategic academic goal to improve teaching and learning.

Technology Change for Academic Purposes

At two public baccalaureate campuses in North Dakota that enroll 750 and 1,100 students, every student and faculty member has access to a high-powered notebook computer and the Internet from classrooms, offices, libraries, residence halls, and off-campus sites 24 hours a day, 7 days a week. Each campus has 1,200 laptop ports, which enables students and faculty to have such access.

Valley City State University and Mayville State University, the two campuses, provide all faculty and students with notebook computers. Valley City started this practice in 1996, with Mayville beginning it in 1997, the second and fourth institutions in the nation to implement this approach campuswide. Nearly all classrooms have power and network connections to every student seat, with multimedia presentation equipment in each room. Networked printers are scattered throughout the campuses, along with convenient access to scanners, digital still and video cameras, CD-ROM burners, and other digital tools. The libraries provide access to a wealth of digital resources available both on-campus and via the Internet.

The two universities were both founded as traditional, public institutions in 1889. They now emphasize teacher education, business, and liberal arts. Located in small towns 75 miles apart in the relatively populous eastern portion of North Dakota, these institutions face difficult economic and demographic circumstances. North Dakota ranks last in faculty salaries and is among the few states that are losing population. The number of high school graduates will decline an estimated 25 percent in the next eight years. In addition, the purchasing power of the campus budgets has decreased by 26 percent in the last twenty years, and the universities' endowments are under $2 million. Although the universities are constitutionally autonomous, they have shared at least four senior administrators (and sometimes as many as nine in the last six years) to reduce overhead costs. In short, these are not the kind of institutions most people would expect to be national leaders in the use of technology for instruction.

Both universities see the new technologies as tools for teaching and learning, not as ends in themselves. And teaching and learning have certainly changed. For example, according to a national study, 23 percent of all college faculty use the Web as a resource (Green 1999). At Valley City, that figure is 92 percent (Valley City State University Grant Proposal for Faculty Development 2000). Nationally, 19 percent of faculty use multimedia in instruction compared with 48 percent at Valley City. Fifteen percent of all faculty members use CD-ROMs in teaching compared with Valley City's 81 percent, and more than three-fourths of the Valley City faculty rate themselves as "high" in technology skills.

In surveys conducted by Valley City psychology professor Kathryn Holleque (Holleque 2000), students report changes in learning as well, such as:

- 87 percent state that they are having more communication with faculty because of computers.
- 84 percent say it is now easier to be more actively involved in learning.
- 83 percent say technology helps them take more personal responsibility for their learning.
- 82 percent say it helps them better integrate and organize knowledge in meaningful ways.
- 73 percent report that it increases their curiosity and interest in learning.
- 91 percent say technologies enhance learning.

The universities have created chief information officer (CIO) positions to support this technology initiative. The CIOs report to the academic vice president, confirming that the primary purpose of universal computing is to improve learning. They have expanded their help-desk staff, predominantly with student workers. Each campus has a representative Technology Planning Committee (TPC), including faculty, staff, and students, to provide strategic advice and set budget priorities for technology.

In each of the last four years, the campuses have spent the equivalent of about one-fourth of their operating budgets on the notebook computer initiative. The universities have received no state funding for this project and are traditionally poorly funded by the state. For every state dollar per student given to public universities elsewhere, North Dakota universities receive 77 cents. Grants, student fees, and reallocation are the only revenue sources for the notebook initiative. The student technology fee is $950 a year, bringing the total cost of tuition and fees for an in-state student to about $3,000. The fee covers the student's computer and software, printing, and a share of the help-desk cost.

Students' willingness to pay the fee enables the universities to capitalize on the latest advances in technology, changing an equipment replacement cycle of 10-plus years under state funding to a two-year cycle. The increase in computing support costs is modest because of standardized software and hardware. Users are on their own to find support for any additional software they prefer. Currently, the standard hardware is the IBM ThinkPad 390, and the standard software is the latest version of Microsoft Office. Each campus also has standard antivirus software. Initially controversial, hardware and software standardization is now accepted as an advantage for communication, planning, and cost-efficiency.

The two universities are examples of institutions that have made complex, expensive technology decisions that were driven by strategic academic goals. The original goals were to (a) enable all classes to capitalize on the increasingly rich array of electronic learning aids and (b) ensure that students would graduate with extensive technology experience for the world of work, regardless of major field. The goals now include the establishment of individualized learning that is customized to suit diverse learning styles, different paces in mastering course content, and varying interests and schedules. In addition, the universities aim to capitalize on distance learning options, both as providers of distance learning and as recipients of it.The two universities are also examples of how technology can impact overall institutional planning.

University Planning in a Technology-Intensive Setting

In four short years, these two universities have changed in almost every way and continue to do so. The changes are only partially attributable to technology. What transforms the institutions is the driving force of the strategic academic agenda: the improvement of teaching and learning. If that agenda is the engine, then technology might be the transmission—utterly essential and constantly changing gears.

Development of the notebook initiative. The universities undertook a formal, extensive technology planning process in 1995 to lay the technical foundation for the notebook initiative. That process continues today and is vital to ongoing success, but it is not addressed fully here, where the focus is on how the notebook initiative affected university-wide planning. To summarize briefly, the process began with the TPCs conducting a comprehensive inventory and assessment of existing technology resources. The committees used that information to decide how to deploy those assets, both to support the notebook initiative and to backfill so that support staff would have the best available desktop equipment in accordance with their needs. Today, the TPCs define specifications for the notebook bidding process and make the selections. The TPCs have control of nearly all university equipment funds for the first few years and continue to control a majority of those funds. They annually survey technology-related needs campuswide, set priorities among them, and use both equipment reallocation and the universities' equipment budget to meet needs in priority order.

Today the universities' planning process encompasses not only technology but also, much more thoroughly than before, faculty development and staffing issues. In addition, it is engaging fundamental issues about how the universities operate in new ways, aiming toward comprehensive transformation to improve both learning itself and the universities' market position.

Faculty development. The decision to undertake the notebook initiative benefited from extensive campuswide consultation. It quickly became clear that the key to success would be faculty skill and comfort in using technologies, achieved as much as possible before students received their computers. By ensuring widespread academic use of technology, the universities could gain their learning benefits for students more quickly and better justify the additional student expense.

For years, the universities had extremely limited state funding for faculty development. Fortunately, a major regional foundation took up the cause. Faculty defined their development needs, wrote a three-year foundation proposal, and implemented the proposal when it was funded. At Valley City, the theme had been instructional technology since 1990. Nearly all faculty had several opportunities to learn new skills and apply them to instruction. They developed skills and a growing sense of mastery. Hence, the decision to implement the notebook initiative by the fall of 1996 was a logical outgrowth of the university's trajectory. Mayville's grants, on the other hand, had been focusing on cooperative learning, which the faculty adopted campuswide. The Mayville faculty needed time to learn the technologies and adapt their courses. Fortunately, a 1995 grant to both universities focused on improving learning with technology and provided each campus with a staff person who provided instructional technology support. Mayville took advantage of that year to launch a focused program of faculty development and provided students with computers in the fall of 1997.

The institution that places technology ahead of or apart from its mission of teaching and learning is imperiled.

The faculty development history of these campuses differed favorably from that of many other campuses. There was a tradition of bringing experts to campus for all to share, as much as, or more so, than sending faculty away for individualized learning experiences. In addition, there was a tradition of focusing all faculty on a single theme for development. Three planning-related changes occurred. First, the universities gained staff devoted to faculty development. Second, they developed multifaceted and coordinated plans to provide the faculty with targeted learning opportunities, both structured and on demand. Third, while development remained a function that was largely determined by the faculty themselves, university administrators assumed a larger sense of responsibility to ensure that it occurred and had the highest possible level of support.

Administrative involvement has taken several forms, not the least of which is "ear to the ground attention" to faculty needs and efforts to respond quickly when gaps are detected. Gaps in the learning opportunities were largely addressed through instructional technology staff and programming. Gaps in personnel are only now arising. For example, one issue is whether technology use should be a factor in faculty evaluation. What has kept this from arising sooner is the emphatic focus on technology as a tool, not a goal in itself. Similarly, Mayville does not evaluate the use of another tool, the teaching strategy of cooperative learning, even though it is a university-wide commitment. However, with experience, some are beginning to develop what might be called a new sense that the faculty may have some compelling responsibilities in the use of technology. These include ensuring that graduates have become exceptionally proficient in the use of technology for their success in the workplace. In addition, faculty may have an obligation to model effective use of technology for students who will become teachers. Discussion of the appropriate role, if any, of technology use in faculty evaluation is under way.

On the personnel side, the administration deals with issues related to faculty involvement with technology and faculty turnover. No situation has prompted a negative impact on individual faculty members in terms of their evaluations or status. However, a small number of retiring faculty may have timed their retirement decisions because they wished not to deal with the changes around them. The universities continue to experience a normal amount of faculty turnover, raising the question of how best to ensure technology skills among new faculty. Very few universities provide faculty with this easy opportunity to use technology during class. Therefore, applicants often are not very familiar with the learning software and Web resources available and have not incorporated these into their syllabi. The universities have modified their search announcements and procedures accordingly, and they have established mentoring programs between experienced and new faculty to aid with the transition process.

Planning for staff changes. One of the greatest challenges of the transformation was defining its staffing needs in terms of numbers and qualifications. Table 6.1 displays the changes in a general way. Most were information technology professional staff positions, but the universities also needed IT support for the faculty. Each year, Valley City and Mayville addressed the most obvious and compelling needs, processing those decisions through two filters. The first was the universities' strategic plan—either the plan gave guidance on how to proceed or the pressure to address a key need led to revisions in the following year's plan. The second was a new human resources planning policy. Each time there is a vacant position, the relevant vice president must present a statement on how the position (refilled or revised) would support the universities' strategic plan, whether and how to fill the position, and a description of alternatives considered. The justification process itself and discussions in the executive team have led to a number of revised or reallocated positions, often in the direction of requiring greater expertise in IT applications regardless of the position.

Impact on transformational issues. Technology is a tool kit, and new tools find new uses. On remote rural campuses, faculty may long remain relatively unaware of the potential for technology to help them achieve their aspirations for teaching, learning, and innovation. Instead, at Valley City and Mayville, a number of new opportunities and expectations are cropping up.

These universities have begun to question a broad array of topics, including the definition of an academic course, the qualifications of faculty, the content and arrangement of faculty work, the relative value of staff versus faculty, the criteria for faculty evaluation, the course registration system, and the institutions' methods of charging for services and counting enrollments. Issues such as these often arise in the normal course of business, but with the fundamental changes now under way, many of them take on a new urgency. Other issues arise from the dawning realization that the technology makes it possible to pursue initiatives that were not feasible without it. As an example of both urgency and feasibility, the definition of faculty work now needs to include providing time for key leaders to help the institutions develop models for student electronic portfolios, which Valley City now requires and Mayville encourages.

The next development on both campuses will be individualized learning—making the curriculum increasingly available on an anytime, anywhere, any pace basis. Recognizing that some other institutions and a growing number of private firms have greater resources for developing distance-delivery curriculum, the focus at Mayville and Valley City is on breaking the time barriers in traditional instruction, with greater attention

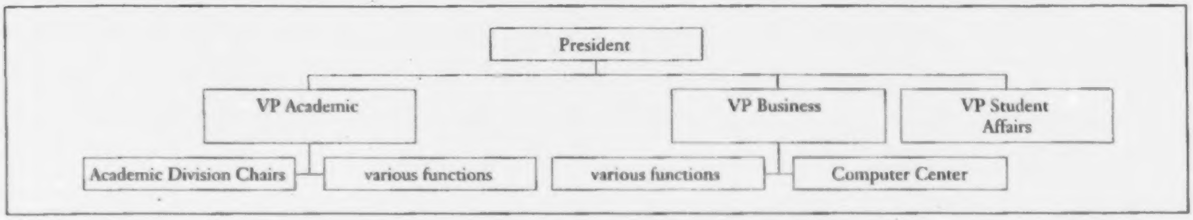

Table 6.1 Structure Before the Notebook Initiative

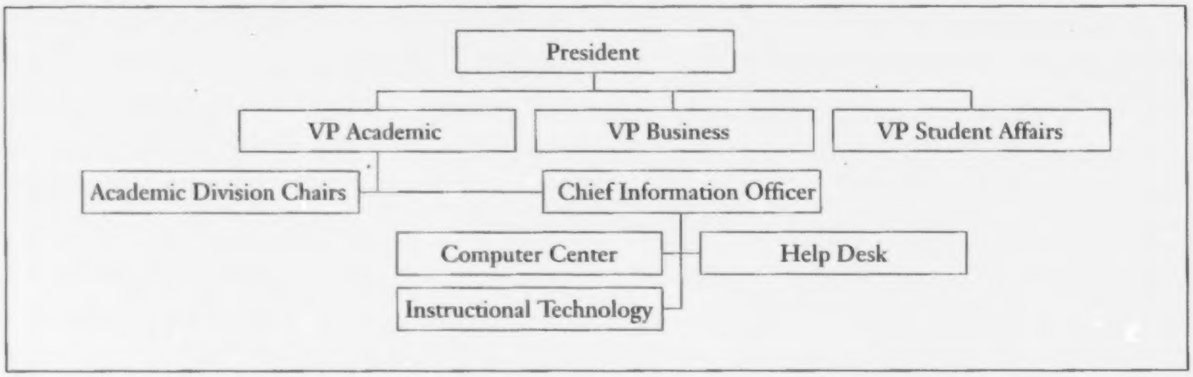

Table 6.1 Structure After the Notebook Initiative

to student outcomes and less to "seat-time" or schedules. The faculty believe that such changes will better accommodate student learning styles, backgrounds, and goals. They will better mesh with work schedules for learners of all ages. These changes, therefore, will enable the universities to seek new markets to adjust for an expected decline in traditional markets.

In addition to changes in the institutions themselves, the notebook initiative is generating changes in external relations that impact planning. The initiative has provided the universities with greater experience in outsourcing. The first intensive wave of faculty development in IT came from a statewide center devoted primarily to K–12 teacher training in IT. In another example, when an outstanding young network engineer left for family reasons, Valley City was unable to replace him at a reasonable price. The solution was a combination of outsourcing the most technical functions and promoting a young staffer, which included an ample professional development budget for the promoted employee.

Since telecommunications infrastructure is a major issue in rural locations, the universities have become much more involved with related utility businesses and economic development groups. Although economic development groups are directly involved with university planning only to a limited extent (representation on a key committee), the universities have worked with them to gain information needed in the planning process. In addition, the two institutions are working with local economic development agencies to build technology centers and attract new businesses, often with agencies' having access to technology-savvy students as an important part of the package. The universities also have developed customized curriculum to meet the entry-level knowledge and skill requirements for employees of a major software firm in the region.

Impact on planning horizon. Perhaps the most obvious change in planning is symbolized by the fact that the strategic plan is a one-page document that is revised annually (see figure 6.1). The first such plan was the product of extensive campus engagement in 1993–94 to help the then-new president identify priorities and trajectories. The notebook initiative came later, so it did not cause the form of the plan. Nevertheless, the plan's form and revision schedule help the universities respond, with increasing experience, to changing technologies and changing priorities about how to capitalize on new technologies. Since neither campus had a recent history of involvement

PURPOSE

Mayville: To establish a customized approach to learning that enables each person or organization to have effective, convenient, and efficient access to an educational process that supports independent progress toward their goals.

Valley City: To develop a customized approach to learning that enables each person or organization to have effective, convenient, and efficient access to an educational process that supports progress toward their goals.

Emphasis for 1999–2001 is on:

- defining and documenting the outcomes of learning
- using instructional technology to move toward individualized learning within the classroom setting
- establishing and building strategic connections with organizations and communities
- identifying and developing innovative scheduling and delivery modes

Current reality: We have a strong foundation of commitment to learner-centered education, personal service, and universal access to notebook computers. These and extensive faculty training and curriculum development provide tools that can be used for setting learner goals, tracking learner progress, supporting independent study, and enabling diverse learning methods. We have a fledgling level of involvement with the educational needs of businesses, communities, and other organizations, which has created valuable friends/advisors and a positive reputation. Challenges include identifying and developing the best tools and approaches for learning management and individualized curriculum, developing methods of reaching learners at a distance, dealing with incentives and constraints imposed from outside, and moving quickly enough. In these and all other initiatives, we must identify effective methods of increasing enrollment and reducing our dependence on state funds.

Figure 6.1 1999–2000 Strategic Plan for Mayville State University and Valley City State University

in formal strategic planning in 1993, the unusual form was not an issue among campus constituencies.

The universities need a strategic plan that is widely understood and responsive to rapid changes. They needed to establish the notebook initiative as the first in a series of changes aimed at better teaching and learning, not as a onetime major event. The institutions are much more dependent on staying reasonably current with technology than they were before, and they are eager to realize further gains from its use. They need a plan that gives enough detail for coordinated action but not so much that the details would be obsolete before they are implemented. The plan has to be flexible and also needs to lend itself to direct translation into individuals' action plans to achieve the planned results. The brevity of this plan helps achieve those goals.

For long-term guidance, the plan's one-sentence purpose statement has a six-year time horizon. In addition, although the four major goal statements change each year, they always address the four points in the universities' vision statement: (1) to maximize learning for a lifetime, (2) to share and develop resources, (3) to provide operational efficiencies, and (4) to document results. An introductory paragraph summarizes the current state of progress toward the purpose statement, and the specific goals and strategies reflect appropriate next steps. Each senior officer is responsible for goals and strategies in his or her area.

The administration publishes the new plan, together with a review of achievements for each goal in the previous year's plan, in a small booklet of key university statements (including, for example, the university's mission, vision, organizational chart, and management philosophy) that goes to every employee at the beginning of each academic year. Given the rapid pace of change and the scarcity of resources, time needed to assess plan achievement is at a premium. The review of prior-year achievements is the only direct assessment of strategic plan implementation. Committees and officials involved in developing the new plan use their day-to-day knowledge of implementation gaps as they work toward revising the plan for the following year. In addition, the universities issue an annual "report to investors" that focuses on trends in key performance indicators such as enrollment, student satisfaction, placement, and finances. Through this report, both cam-

Strategies for Achieving Goals	Responsible
Goal 1. Maximize learning for a lifetime.	
a. Continue development of portfolio models.	AA, CIO
b. Define and implement an "entrepreneurial" summer school.	AA
c. Make policies and add courses for dual enrollment.	AA
d. Develop and offer certificate programs (15 credits or less).	AA
e. Make articulation agreements for the IT track and other programs.	AA
f. Maintain Tech Ed and customized learning progress per Title III (Valley City).	AA
g. Develop assistance program for reading skills (Mayville).	AA
h. Launch major focus on IT programs and opportunities for the next strategic plan.	AA, CIO, EC
i. Submit successful Bush proposal for faculty development (Valley City).	AA
Goal 2. Document results to confirm and improve quality.	
a. Adopt information and organizational systems to support individualized, one-to-one contact/marketing.	SA, CIO
b. Make substantial progress on NCA and NCATE self-studies (Valley City).	AA
c. Complete planned academic program reviews, with appropriate collaboration between Mayville and Valley City.	AA
d. Increase public and legislative support for vision and progress.	EC
Goal 3. Provide organizational efficiencies that focus on service to learners and innovative delivery methods.	
a. Provide training for all faculty and staff. Emphasize supervisory and communication skills.	AA, SA, BA, CIO
b. Ensure that faculty develop and document competencies and skills in technology.	AA, CIO
c. Identify and implement methods of providing faculty with more time for innovation.	AA
d. Pursue options for recruitment as defined in the SEM plan. At Mayville, achieve results for the 200x2000 campaign.	AA,SA
e. Identify and pursue technological methods of improving student services.	CIO, SA
Goal 4. Share and develop resources through collaborative efforts between Mayville and Valley City (and others, as appropriate).	
a. Develop regional technology centers.	EC, CIO
b. Recruit people for the information technology track and other tech-related fields.	SA
c. Fulfill the cross-training expectations for the joint Title III grant.	AA, CIO
d. Develop new and expanded international initiatives.	AA
e. Make a final decision about whether to pursue a joint two-year program in Jamestown.	AA
f. Identify and pursue methods of enhancing IT instruction through collaboration.	AA

EC=Ellen Chaffee, AA=Academic Affairs, BA=Business Affairs, SA=Student Affairs, CIO=Chief Information Officer

Figure 6.1 1999–2000 Strategic Plan for Mayville State University and Valley City State University

pus and external constituencies remain keenly aware of overall outcomes.

It stands to reason that a one-page strategic plan has very little detail related to technology per se. That detail is contained in a separate technology plan, which is also updated annually. A fringe benefit of this approach is that it helps ensure that the universities do not become overly enamored with technology itself. The strategic plan keeps all eyes on the strategic academic target, including those of the members of the TPC. The TPC presents an annual report to the university-wide planning committee. Each CIO chairs his respective TPC and is a member of the campus executive team. The team, in turn, bears primary responsibility for managing the strategic planning process and determining its final form. Those links balance technology needs and university strategy while assuring adequate attention to both.

This approach to planning and assessing may very well be inadequate to the needs and complexities of larger universities. On these two campuses, it is relatively easy to gain a comprehensive view of what is happening and a reasonable consensus about what needs to happen next. In short, the universities' planning processes have taken on a shorter time horizon, engaged more people throughout the universities on a continuous basis, and taken more explicit account of all technology-related needs in the context of the universities' strategic direction. The strategic plan may also be a much more "living" document than is true on some campuses, if only because it is a formal, explicit agenda item for several groups every year.

Funding issues. Expensive as it is, the notebook initiative has raised a number of funding issues that were new to the universities.

The first and most obvious was the cost of hardware, software, and networking. Grant funds, reallocation, and student fees supported these costs. During the early years of the change to universal computing, the TPCs were responsible for allocating nearly all equipment funds. The groups had developed a comprehensive plan to launch the notebook initiative, which drove their decisions in those years. Soon, however, departments began to feel the pain of doing without updated electronic equipment. The benefits of the new technologies made them exceptionally patient, and eventually modest funds were returned to the departments through the planning process. Electronic equipment decisions continue, for the most part, under the TPC annual planning process, with departments submitting their needs to be placed in university-wide priority order.

A growing number of individuals have become active grant proposal writers. They also tended to be among the most actively engaged in the transformation. Through coordination and consultation, they were able to request and gain funds for some of the needed equipment as part of broader programmatic grants. The universities also have sponsored faculty to write specific major proposals to underwrite the costs of the initiative.

The student fee was the most risky decision. It raised the total cost of tuition and fees by 50 percent in a single year. Thanks to extensive student involvement in the decision to "go laptop," the fee caused no apparent decline in the enrollment figures.

A significantly beneficial side effect of the fee was to raise students' desire to get what they were paying for. In the first year, and with new faculty thereafter, the administration advised faculty to include up-front information about whether they would be using technology in their class and, if they were not, to explain why not. Students seem to have accepted reasonable explanations, but they have become actively involved in encouraging appropriate technology use.

Technology is pressuring every university—the only differences may be how fast is the response, how deep is the well of resources, and how mature and focused is the planning process.

Another major benefit has been changes in the faculty-student relationship. In addition to becoming more proactive with faculty in stating their expectations, students have become colleagues with the faculty in teaching and learning the technologies. Fortunately, most of these faculty members were not threatened in the early years by their students' sometimes greater expertise in this area.

The universities are no longer in a position to ignore or defer investments to keep pace with the rapid changes in technology. At this point, high-speed telecommunications infrastructure is the major challenge because of the cost of bringing this capability to rural areas. The initial expectation that computers could be replaced on a three-year cycle has yielded to understanding that two years is the limit because the machines are too outdated by the third year.

Finally, people at small baccalaureate campuses tend to expect that salaries will be equitable without regard to market issues. The national shortage of IT workers, their skyrocketing salaries, and the necessity of having adequate IT staff to support the notebook initiative have conspired to require the administration to develop a market adjustment plan for positions in this field. The emphasis is on higher salaries, more funds for professional development, and more innovative approaches to staffing for IT functions. University personnel who are not eligible for the market-driven accommodations do not appreciate this, especially given all the hard work and sacrifice they have given to get the universities to this point. One element that softens some of their concerns (and another aspect of the increased attention to internal promotions) is a commitment to assist those wishing to become qualified to teach in IT fields or perform IT staff functions. Administrators are also working with faculty to define a more entrepreneurial approach to summer school that has greater income potential for them, with or without a technology focus.

New program development. While all of the factors identified above affect planning, other factors also enter in. A major emerging element is new program development. After years of pruning and consolidating, the universities are motivated to develop new IT-related curriculum and infuse IT content into an array of existing courses and programs.

The recent changes have brought faculty and staff into much greater contact with the outside world. They have visited other campuses and hosted visitors from all over the nation and several international countries. The idea quotient is rising, with more people making suggestions and bringing options to the planning table. Whether these ideas relate to new programs, changes in existing programs, new ways of delivering instruction, or efforts to recruit appropriate IT and non-IT personnel, most of them raise new issues for the institutions. They either bring new content issues to the university planning process or prompt new planning modules through special processes "on the side" that address the issues and bring recommendations to the planning process.

Conclusion

Technology is pressuring every university—the only differences may be how fast is response, how deep is the well of resources, and how mature and focused is the planning process. These two institutions, with their rapid response and low resources, have turned to face the technology monster, and they have done so by putting their teaching and learning priorities first. Technology is not an important adjunct to their missions but a means to achieve them. With this perspective, the universities are better positioned to identify which of the commonly felt technology-related pressures require an institutional response. Those that provide key threats or opportunities to the academic mission are on the table; those that do not, fall away.

Planning is becoming a way of life. In ways not seen before on these campuses, planning is on virtually every agenda, not for the sake of dealing with technology but for achieving what technology makes possible. Planning is both highly centralized in a single sheet of paper and highly participative, as technology inspires new aspirations and commitment.

Attitudes toward change are different now. Rather than resent or resist, most people seek and embrace technology; it has given them a new sense of possibilities and a new sense of mastery. They have done something that many thought was impossible, and no worthy new challenge daunts them. But to address each challenge, they must plan.

Communication and relationships among faculty, students, and staff are stronger. This outcome is increasingly important. At the outset, campus personnel believed that if they could just survive the first year, they could coast after that. However, each year has brought substantial new challenges. Some of them deal with technology itself, including staying reasonably current with technology, finding ways to staff in a very tight IT market, and inventing ways to support new faculty in their transition to a notebook campus. Others deal with the strategic academic agenda, such as breaking the instructional time barriers, identifying an appropriate role in distance learning, and making technology an integral part of the curriculum. Communication is essential to teamwork, and only through teamwork can campus personnel deal with such issues.

A recent candidate for a campus position observed that on some campuses people with new ideas run into barriers and ultimately feel they have to leave their institution to pursue their ideas. At Valley City and Mayville, on the other hand, the commitment to pursuing new ideas acts as a magnet to attract people, not send them away.

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7

Cycles in Curriculum Planning

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The term "life cycle" is used in other chapters of this book to refer to planning for the useful life and timely replacement of equipment. How does this term apply to curriculum? When is a curriculum in need of an upgrade or replacement?

Changes in curriculum might arise in response to new knowledge, a breakthrough in the field. This kind of change takes place in an ongoing discussion within and among the disciplines, and even leads to the creation of new disciplines.

Curriculum change can also come about when discoveries in cognitive science and pedagogy lead to new understanding of the way people learn. All too often, the college and university curriculum has emphasized content in isolation from the learning process. In recent years, with the growing diversity of our student population, higher education has discovered the importance of designing curricula that will maximize student success, and this has led to a new interest in the learning process. Such change has certainly influenced the curriculum reform efforts that have taken place at Rensselaer Polytechnic Institute and will be discussed in the examples that follow.

Another way change in curriculum occurs is when new technologies fundamentally alter the way work is done and knowledge is discovered. Technology can change the way our students live and the way professionals in their field go about their work to such an extent that it demands to be incorporated into the curriculum (Katz and Rudy 1999).

Life-cycle planning in curriculum must take into account all of these sources of change. Unfortunately, it is not subject to easy formulas but must be constantly under review. And our mark of success is the achievements of our students. The challenge is not new: a study of engineering education commissioned in the 1920s expressed concern with the poor preparation of entering students and excessive focus on cramming as much material as possible into the curriculum (Society for the Promotion of Engineering Education 1930, 32–36).

Institutional Initiatives–Rensselaer as a Case Study

In the late 1980s, Rensselaer embarked on a planning process called the President and Provost's Panel on Strategic Initiatives. One of the goals of the panel was interactive learning. Rensselaer had long been recognized as an institution that emphasized undergraduate education. But changes in the student body led many faculty to explore ways of improving the learning experience. "Interactive learning" was a term that covered a number of ways of engaging students more actively in their own learning; this might be with the aid of computing technology, with team-based learning, or with hands-on experimentation or design.

Discussion of the learning process drew the participation of faculty across all schools and departments and led to a number of innovative learning initiatives. Computer

Calculus, which was enabled by new symbolic computation tools, led to new realizations of how to teach calculus concepts. Strategic Applications followed a systems approach to the curriculum that equipped students with tools and concepts that applied across the curriculum. In Studio Physics the change of course format and environment led to increased learning and new efficiencies. The 4 x 4 curriculum, taking a systematic approach, reexamined the relationships among courses and streamlined the students' schedule to allow more depth and flexibility. The Information Technology curriculum built on existing strengths and a tradition of multidisciplinary studies to design a program that met a growing demand for a new kind of graduate. Finally, the introduction of a new laptop requirement reinforced all of these curriculum changes with a ubiquitous computing environment.

The faculty, with the help of some dedicated and talented staff, have driven these experiments with new pedagogies and technologies to improve the learning environment for our students. It is their desire to continually improve and innovate that has earned Rensselaer the Theodore M. Hesburgh Award,' the Boeing Engineering Educator Award, and the Pew Charitable Trusts Leadership Award for Renewal for Undergraduate Education.

Computer Calculus

In the 1980s higher education faced a crisis in the teaching of calculus. This course, which served as the foundation for many later courses in science, engineering, and business, was often a stumbling block for freshmen who might otherwise enter these fields. Robert White, then president of the National Academy of Engineering, called calculus "a critical way station for the technical manpower that this country needs" (Cipra 1988). Yet at some institutions it was reported that up to 50 percent of the students taking calculus either failed or withdrew from the course. Many reasons were offered to explain this rate of failure: poor preparation in high school, watered-down courses that gave students a false sense of security without real mastery, and textbooks and classroom techniques relying on outmoded pedagogy, such as repetition and passive listening in large lecture classes.

In 1988 the National Science Foundation earmarked more than $1 million for an initiative to reform the teaching of calculus. Led by William Boyce from Rensselaer's Department of Mathematical Science, a group of five professors received a grant for comprehensive curriculum reform under this program (Boyce and Ecker 1994). Boyce stated that the way to improve the teaching of calculus was to place less emphasis on pencil-and-paper calculations and more emphasis on mathematical concepts and their use in problem solving, mathematical modeling, and the interpretation of results. Computers offered a means to do this. In the summer of 1988, he and Bernard Fleishman worked with a group of graduate and undergraduate students and computing support staff to prepare instructional materials for a pilot course in calculus using the Maple™ symbolic algebra program developed at the University of Waterloo. The plan was to integrate the new approach into the entire mathematics curriculum, starting with first-semester calculus. This would allow one class of students to proceed through the sequence as each new course was introduced.

All too often, the college and university curriculum has emphasized content in isolation from the learning process.

By the 1990–91 academic year, all of the first-year math courses had been converted to the new curriculum, making Rensselaer the first major research university to have all of its freshmen learning calculus using a computer algebra system on state-of-the-art workstations. Maple is now used extensively throughout the mathematics and engineering curricula.

Boyce and his department chair, Joseph Ecker, identified the following three motivators for this change:

- Helping students become comfortable with the increasingly computerized environment in which engineers and scientists work
- Allowing students to solve the kinds of problems that confront working scientists and engineers, rather than textbook examples
- Improving instructional methods in ways that would help students visualize relationships more clearly (especially in three dimensions) and encourage them to take a more active role in their learning

The computer made calculus more like a laboratory course in which students were actively involved in experimentation with various possibilities, not just solving a given set of problems. Boyce predicted that students would also find Maple useful in their courses outside math and in courses that didn't specifically require its use.

Computer Calculus expanded to reach courses in Computing Across the Basic Sciences, a program embracing chemistry, physics, and computer science. More than 500 workstations were connected to the campus Ethernet in classrooms and public laboratories that were available for scheduled instruction and student assignments across the curriculum and around the clock. Computer projection equipment in the classroom allowed faculty to give spontaneous demonstrations during their classes. To facilitate the use of computing across the curriculum, a suite of software applications was provided on all the systems; these included a word processor, an electronic spreadsheet, electronic mail, and a computer-aided design package. It is important to emphasize that in all of these initiatives, the need for curriculum change drove the selection of the computers and software. The hardware selection team used benchmarks based on the curriculum. And a committee of faculty and staff identified the need, outlined the requirements, and tested the available software before choosing each software package for the new Rensselaer Computer System. A major criterion was the usefulness of a package throughout the curriculum and in a student's career, not just in a particular course.

Although the campus computing environment has undergone major changes, which are described below, the technology-rich curriculum introduced in 1990 is strong and continues to grow today.

Strategic Applications

The School of Engineering was interested in taking more of a systems approach to understanding the broader software technology implications to the curriculum. What developed was the notion of strategic applications across the curriculum (Kolb et al. 1991, 59–65). The idea was to find strategic applications and understand their use in various courses in the curriculum as a student progressed in his or her field of study.

A strategy of vertical integration of computing tools into the curriculum was developed. To have lasting penetration into the curriculum, into the learning process, and eventually into engineering practice, three things were needed: (1) a formal methodology for developing engineers' computing skills over several courses, (2) a synergy between instruction of computing skills and of engineering theory, and (3) identification of strategic applications for instructional computing. Also defined were core, intermediate, and advanced skills (see figure 7.1), which were then mapped into several application areas and outside the curriculum.

Core Skills

- Learn to use a computer-based tool
- Apply the tool to basic problem solving
- Adapt the tool through "macro" programming

Intermediate Skills

- Master more advanced tool functions
- Apply the tool to complex, discipline-specific problems
- Understand basic analytic principles underlying the tool

Advanced Skills

- Interface among multiple tools
- Program new tool capabilities
- Understand the tools' analytical and numeric techniques and associated limitations
- Apply the tools to open-ended inter-disciplinary problems

Figure 7.1 Core, Intermediate, and Advanced Skills for Computing

Maple, for example, was introduced in the beginning calculus courses, then reinforced in later courses, such as Introduction to Engineering Analysis (IEA) and Introduction to Differential Equations.

There were similar "application threads" in computer-aided design and in courses that used matrix computation and systems analysis and control techniques. Some tinkering did occur with some of the sequences. For example, in the original planning, it was expected that the package MATLAB™ would be introduced in the IEA course (a first-year course). However, there was concern about a first-year student being on too many application learning curves at one time. Hence, the course leader decided that it was better to reinforce the Maple usage in calculus in this course. The introduction of the MATLAB package was then moved to a course in the sophomore year.

The progression of computing skills from just learning how to use a package to mastering the use and application to understanding how to use the application in new "what if" scenarios was very powerful.

Studio Physics

In 1990, Jack Wilson came to Rensselaer from the University of Maryland to become the first director of the Lois J. and Harlan E. Anderson Center for Innovation in Undergraduate Education. He initiated the use of the Comprehensive Unified Physics Learning Environment (CUPLE) (Wilson 1994) in the introductory physics courses and then began to experiment with a new format derived from workshop physics, which was named Studio Physics (Laws 1991).

The purpose behind Studio Physics was to integrate the various parts of a typical physics course (lecture, recitation, and lab) into a single meeting while employing advanced educational technology to significantly affect student learning. The traditional approach had been to divide the course into two lecture sections with approximately 350 students each and then subdivide further into about 20 to 25 recitation sections of fewer than 30 students and 20 to 30 labs of fewer than 25 each. The approach used in Studio Physics divides the students into 12 to 15 sections of 48 to 64 people. Faculty members teach sections, with two to three teaching assistants each, usually one or more of these being an undergraduate teaching assistant. Instead of meeting for two hours of lecture, two hours of recitation, and two hours of lab, the studio sessions meet twice a week for two hours at a time, reducing the number of contact hours from six to four.

The studio requires a new way of teaching and a new classroom design (Wilson and Jennings 2000). Faculty no longer lecture for the entire class. Instead, the session is scripted to alternate between short lectures and hands-on activity by the students. A class typically starts with a discussion of the previous homework assignment, similar to what might occur in a recitation section. Next, a short lecture is given on the day's topic, working toward either an in-class problem or an experiment. Either the problem or the experiment might require interacting with CUPLE modules that provide tools and instructional programs on the topics being studied. The focus of the studio is on the student's activity, not the professor's.

To support this new style of teaching, a new classroom was designed to hold approximately 50 students and include a workstation that accommodates two students, an open work space, and space for equipment needed for the day's hands-on lab. The workstations are arrayed in three concentric horseshoes, with the instructor's station at the open end. When the professor talks to the students, they face forward and the workstations are behind them. During the activity, they face away from the center of the room and work at their workstations or lab experiment. This arrangement allows the professor to view all the workstation screens from the center of the room, giving him or her quick feedback on the students' progress. Faculty like this arrangement because it facilitates interaction between student and professor.

Early pilot projects of Studio Physics showed that the majority of the students favored this type of learning environment, and faculty who participated were not interested in returning to the traditional environment. The faculty found that through the increased interaction with the students, they received much more immediate feedback on the students' progress. Rather than wait for quiz or exam results, the faculty found out almost immediately if the students understood what they had just discussed. The faculty also got to know their students much better, and the students were less apprehensive in approaching faculty for help because they were used to talking with them in class.

In all of these initiatives, the need for curriculum change drove the selection of computers and software.

The final major hurdle for Studio Physics was cleared when the Physics Department voted to adopt this method as the means for delivering its introductory physics curriculum. This is quite an astounding decision in some ways when you realize that this new mode of teaching was going to require more faculty resources than before. However, the experience and evidence clearly indicated that the old method of teaching these courses had reached the end of its usefulness. There was considerable potential to improve student learning through educational technology, but it was not going to happen unless the technology was tightly integrated into the course structure. The studio method enabled that improvement for introductory physics.

4 x 4 Curriculum

In the 1994–95 academic year, Rensselaer embarked on an institute-wide self-study in all areas of its operations, including the curriculum. The Designing and Delivering of Curriculum Process Team went through a number of focus group meetings and a comprehensive review of the state of the art. Two defining issues surfaced from the team's work: (1) the need to decrease student workload and (2) the desire to replace large lecture classes with the studio method described previously. In the first case, some students found themselves juggling five to six courses per semester. With this load, students found it difficult to devote the time needed to learn effectively. Many courses made more use of collaborative learning through team projects or required more preparation by the students before class. In the second case, faculty teaching in the studio mode found that two-hour meetings were required to accomplish all the activities they needed to cover in one class.

As a result of its study, the Designing and Delivering of Curriculum Process Team recommended that Rensselaer standardize its curriculum structure on a template of four courses per semester at four credits per course. This became known as the "4 x 4 curriculum reform." In addition, the team proposed that the maximum number of credits to earn a bachelor of science degree would be 128 and that each curriculum would provide for 12 credits of electives. While not necessarily novel, given that many of the introductory courses were already four credits, the proposal to hold the whole institution to this standard was important for a number of reasons.

1. It was expected that with fewer courses per semester, students would be allowed the time to go into more depth on each.
2. By changing the basic structure of the curriculum and setting a maximum number of credits and a minimum number of free credits, the status quo was not a viable option. Hence, faculty had to rethink the relationships between the various portions of the curriculum and revamp each discipline's programs. This was particularly true for the Schools of Engineering and Architecture.
3. Providing more flexibility for electives in each discipline began to open up the possibility of dual majors and cross-disciplinary minors.

The Rensselaer community discussed the team's recommendations at great length, and the Faculty Senate endorsed the curriculum reform in the spring of 1995. The vote by the Faculty Senate Curriculum Committee was a rare unanimous vote.

The complete conversion to the new curriculum structure was quicker for some disciplines than for others. Both the Schools of Engineering and Architecture, due to the professional nature of their degrees, spent considerable time examining their existing curricula and redesigning for the new requirements. The School of Architecture had a five-year program that wasn't limited by the maximum credit limit, but the school still had to repackage its courses to meet the new structure. Several innovative solutions arose from this work.

The Curriculum Reform Implementation Team was formed, chaired by the dean of engineering, to help resolve interschool issues and any impact on other parts of the university. The Faculty Senate Curriculum Committee worked overtime to review and approve new courses and curricula. In the end, the transformation occurred quite quickly, and the class of 2001 became the first full 4 x 4 class, with all students entering under the new curricula.

IT Curriculum

In early 1997, Rensselaer saw information technology emerging as an important area for development for the university because it was not addressed directly by current programs and it built on Rensselaer's strengths in technology and multidisciplinary activities.

At the end of 1997, the curriculum design group delivered its report recommending the creation of a bachelor degree in IT (Wilson 1998). This group recognized the tremendous demand from the marketplace for IT professionals who can broadly apply information technology to world problems. They also saw the interdisciplinary information technology expertise that Rensselaer already had in place with its faculty. The Rensselaer IT professional was defined with many attributes. However, there were three overarching goals for the graduates of the new curriculum: (1) combine extensive IT literacy with strong preparation in a second discipline, (2) be technically adept and socially aware, and (3) be skillful in continually updating their skills and knowledge base.

Four key components were developed to define the IT curriculum: (1) an IT core (see figure 7.2), which was about half of the total credits when combined with several institutionally required courses; (2) a required second discipline, which was at least 25 percent of the total credits; (3) a commitment to meet Rensselaer's math/science and humanities and social science requirements; and (4) some flexibility for students with free/restricted elective courses. In particular, the second discipline requirement reinforced the strong interdisciplinary nature of this field and the resulting degree program. These students were being prepared to work at the interface of IT and its application.

1. Introduction to Data Structures and Applications
2. Exploiting the Information World
3. Computer Architecture, Networking, and Operating Systems
4. IT Technology Elective (one of)
   - Software Engineering
   - Database Systems
   - Information Systems
5. Managing IT Resources
6. Creativity in Human and Artificial Agents
7. Human Computer Interfaces
8. Probability and Statistics for IT
9. IT Studio / Capstone Experience

Figure 7.2 The Core of the Information Technology Curriculum

A vice provost for information technology was hired at the start of 1998. Instead of a new school or department, an organizational structure was created so that faculty would have cross appointments with other departments on campus. Hence, no faculty would claim IT as their primary home. By the end of 1999, more than one-third of the entire Rensselaer faculty had appointments as faculty of IT. By the fall of 1998, there was an entering class of 50 with IT majors. In 2000, the expectation is that the program will have 150 students per year entering with IT majors.

Ubiquitous Computing

As the use of information technology in the curriculum continued to grow, it became apparent that we needed a new model to give students access to technology (Resmer, Mingle, and Oblinger 1995). With more than 800 workstations in classrooms and labs, we still could not accommodate faculty needs for computer classrooms and student needs for a place to do homework. In the fall of 1997, more than 90 percent of our students were bringing computers with them to campus and using the Ethernet connections in their residence hall rooms to connect to the campus network for e-mail and Web access. A laptop pilot program begun in 1995 sought to test whether the computer-based curriculum could rest on a foundation of student-owned computers. Much of the software selected for the Rensselaer Computing System, at that time only available for UNIX workstations, had become available for Windows-based computers. The heavily scheduled PC classrooms showed that instructors were eager to take advantage of this development.

The Laptop Computer Pilot project began in the fall of 1995 with approximately 85 students. They used their laptop computers in three courses designed for a studio format: Physics I and II, Calculus I and II, and Introduction to Engineering Analysis. The studio format encouraged students to work in teams and take a high degree of responsibility for their own learning. The participating students were self-selected and purchased their own laptops with educational discounts obtained through Rensselaer. The program continued in 1996 and 1997 with approximately 120 students each year. In the fall of 1998, all freshmen were encouraged, but not required, to purchase laptops; however, there was no increase in the number of first-year courses using laptops and no development of courses for the sophomore year and beyond. It was clear that we faced a dilemma: faculty were unwilling to invest the time to develop courses that made use of the laptops until they could be assured that all students would have them.

Therefore, in the fall of 1998, the Campus Laptop Committee, a group of faculty and staff charged to review the pilot program and plan for its expansion, recommended that we proceed with a requirement that freshmen own laptops in the fall of 1999. After a review by the various campus constituencies, the plan was approved and an implementation team was established with members representing all the campus organizations that interact with incoming students. The Leadership Team consisted of the chairs of each of six committees: Acquisition and Affordability, Curriculum, Marketing, Students, Technology and Facilities, and Distribution and Training. This group developed a master schedule for the program and provided overall perspective to the committees and the campus community.

From the standpoint of curriculum, the biggest problem was making sure that the faculty teaching first-year courses had an opportunity to make plans for the use of laptops in the classroom. For many of the faculty, this was a small change because they were already teaching in computer classrooms. But for others, it was a major transformation. To assist them, we provided an opportunity for them to obtain laptop computers identical to those that the students would be using and to participate in a two-day workshop on the use of laptops in the curriculum. This program, organized by the Curriculum Committee, gave the faculty an opportunity to hear from those who had pioneered work with laptops in the classroom at Rensselaer and at other institutions. Faculty who had participated in the pilot program and others who had made innovative uses of technology in the classroom gave demonstrations for their colleagues. Participants then divided into discipline-specific groups to begin plans for their own courses.

The focus of the studio is on the student's activity, not the professor's.

Some departments then continued this planning in their own workshops throughout the summer. As a result, laptops were used extensively in all the large-enrollment freshman courses and in many electives.

To provide the infrastructure for this increase, 24 classrooms were remodeled to provide laptop connectivity for students and faculty. This also included upgraded projection facilities and, in some cases, completely renovated rooms to accommodate the new style of teaching.

Summary Observations

The life cycle of new products is often driven by the advent of new technologies, new processes, or both. Typically, new technologies or processes are tested in limited trials, and as their worth is proven, their use is expanded. This evolutionary approach can take you only so far, and eventually a major redesign is needed to better realize the potentials of the new technologies. The changes we've described here followed a similar path to revitalizing our curriculum.

New technologies, such as Maple for Computer Calculus and the lower cost, higher performance laptops, inspired the Rensselaer faculty to attempt new ways of revitalizing their teaching. The examples show that this began with changing individual courses, calculus and physics. The new technologies by themselves, however, could only go so far, and eventually it was clear that the whole structure of the course needed to be changed to more effectively integrate these new tools into the students' learning. This led to the studio model as a means for increasing student-faculty interaction, facilitated by technology. As the studio model became more widespread, it became clear that there was an opportunity to reform the entire curriculum to take better advantage of the new teaching models; the 4 x 4 institute-wide curriculum reform was the result.

We are now faced with beginning a new life cycle as we introduce ubiquitous computing to our environment. With the introduction of laptop computing for all students, we are entering another new era of reform. We fully expect that faculty will find new ways to teach and interact with their students because they will all share the same tools. We expect that new technologies will be developed to make it easier for faculty to serve more as mentors, leaving the assessment of student learning to other means. With these changes and new technologies that we haven't yet seen, we expect another institute-wide reform in which new ideas about how education should be conducted will be explored and our standard notions of a time and a place for learning will be changed.

In the end, however, we believe that the life cycle of a curriculum is tied to the faculty's desire to succeed. Good faculty want their students to learn. When faced with new facts and news ways to improve student learning, quality faculty will want to study them, embrace them, and share them with their colleagues. At Rensselaer it was the desire of the faculty to succeed at what they did that was the ultimate driving force behind the life cycle of the curriculum.

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John T. Harwood

8

Does a College Curriculum Have a Life Cycle?

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At first glance, the answer to the question "Does a college curriculum have a life cycle?" must be "Yes, of course!" Every college curriculum must have a life cycle because it has an origin, a point at which it becomes a subject that is formally taught. There must surely be a point at which the subject is either no longer taught (e.g., phrenology or alchemy) or has become so altered that modern faculty would not easily recognize it. If a curriculum does have a life cycle, questions arise. Who does the planning? How are decisions made? How are decisions implemented? How are results evaluated? The questions are easy to ask but hard to answer, in part because a curriculum, like beauty, is often in the eye of the beholder. Is the curriculum what is printed in the college catalog or listed on the Web? Or is it something else?

When we talk about a curriculum, what precisely do we mean? A curriculum can refer to the entire undergraduate curriculum, the curriculum for a major, or even the curriculum for a single course. At most institutions, the undergraduate curriculum is divided into at least two phases. The first two years of a four-year program are spent with the general education requirements—several courses in the humanities, the social sciences, the physical sciences, and so on. (Some institutions refer to this as the "core curriculum.") The last two years focus on the student's major. A curriculum must deal with three elements—knowledge, skills, and attitudes—and it must have clearly articulated goals for each of those areas. So we could think about the undergraduate curriculum or the biology curriculum or even the curriculum for a single biology course. In each case, we would be concerned with the knowledge, skills, and attitudes that a student should acquire.

We might also want to know *how* the curriculum will be presented and *how* students will be evaluated. Within many departments are faculty who teach the same courses but have wildly varying theories of learning. The constructivists and the behaviorists may coexist harmoniously as colleagues, but their classroom practices could hardly be more dissimilar. To put it another way, the constructivists and the behaviorists might agree about the educational goals, but they will not agree on the best way to reach them or the most adequate way to evaluate students' progress. For this reason, the concept of curriculum grows more complex because it is embedded in the social history of individual departments and institutions. One thing can be said: where there is a curriculum, there will be efforts to reform it.

A search for the phrase "curriculum reform" in several search engines yielded more than 100,000 results. The Web bristles with reform sites. The University of Wisconsin System hosts an annual curriculum reform institute (www.uwosh.edu/wis/cri.htm) for its Women and Science Program. The Mathematical Association of America (www.maa.org/pubs/books/teaching.html) has a long list of suggested books about the reform of mathematics instruction. The National Academy of Sciences sponsors papers on the reform of the science curriculum (www.nas.edu/rise/backg3a.htm), and the National Science Foundation has

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provided very large grants to reform the teaching of calculus, algebra, and other subjects.

For some majors (e.g., computer science, business, and engineering), the pressure of external accreditation significantly reforms the curriculum because it dictates new requirements.

Not only are individual disciplines reforming their curricula, but a staggering number of institutions are attempting to reform their general education or their core curriculum. General education can be reformed by tightening requirements or by loosening them. Should the general education curriculum include diversity courses or multicultural courses, or should it emphasize Western civilization? Should writing be taught across the curriculum? Should all students be required to take a foreign language or demonstrate skills with computers? Should some or all of the courses in general education require active and collaborative learning? Should some or all of the courses require students to work in teams, do problem-based learning, or address real-world problems? The number of these questions suggests that the pressures and opportunities to reform general education reflect complex social, intellectual, economic, and political forces. These questions also suggest that any discussion of curriculum change must include the context in which courses are developed and offered.

At a superficial level, the curriculum for an institution is what is printed in the college catalog: a list of courses and requirements for a degree. At a deeper level, you cannot tell what the curriculum really is until you become very familiar with the institution's faculty, students, and administration. Sometimes there is more to curriculum reform than meets the eye; oftentimes, there is less.

All this being said, does it make sense to think about life-cycle planning for a college curriculum? To what extent can we describe a process that is analogous to what we can do for the physical plant or for information technology? It is easy to say that software for personal computers has a life cycle of about 18 months—and to budget accordingly. It is far more difficult to predict what pedagogical, political, or social imperatives or opportunities will arise in the future. The launching of Sputnik in 1957 precipitated a national crisis and sparked a huge investment in education, both K-12 and postsecondary, to address the fear that the Soviets' space program would eclipse ours. New institutes for teachers, fellowships for students, massive funding for researchers, and cries for curriculum reform in math and science were all triggered by Sputnik.

Making predictions about technology is risky business, even if your time frame is only a decade. What new technology, for instance, will be invented 10 years from now? How will wireless and broadband technologies transform the opportunities for curricular collaboration? How will disciplinary societies help to promote the development and deployment of learning objects that any teacher can easily assemble into teaching materials? What new collaboration between publishers and higher education will be negotiated? The variables and permutations are endless.

What can be guaranteed is that *some* faculty and *some* administrators will see a curricular opportunity to build new programs or strengthen existing ones. They will respond to pressures from the state or federal government or from opportunities extended by foundations or industry. The curriculum— never fixed and stable, despite what the college catalog suggests—is likely to become more dynamic, not more static. Rather than look further into my crystal ball, I will offer three case studies of curricular transformation in which I have played a personal role. Such case studies may help explain some of the underlying processes and principles that affect the life cycle of curricula at other institutions. I will focus on two large initiatives in the humanities and one even larger initiative that led to the creation of a new college at The Pennsylvania State University.

English 202: A Large-Scale Curricular Innovation

English 202 is the designation for not one course, but four courses at Penn State. The catalog description is rather flat, almost austere. Penn State provides four "flavors" of its junior-level writing class: writing in the social sciences, writing in the humanities, technical writing, and business writing. The courses are designed for students in these four broad areas of study because the faculty of the English department believed that students would be more motivated to write effectively if they were writing about content areas important to their careers. This curricular change was made in 1982, and the following course description has remained unchanged for 18 years:

> ENGL 202A (GWS) **EFFECTIVE WRITING: WRITING IN THE SOCIAL SCIENCES** (3) Instruction in writing persuasive arguments about significant issues in the social sciences. (A student may take only one course for credit from ENGL 202A, 202B, 202C, and 202D.) Prerequisite: ENGL 015 or ENGL 030; fourth-semester standing

What this description fails to capture are two major changes in the way the course is taught. The first dramatic change to the curriculum occurred in 1987–88, when the department proposed to central administration that all students in English 202 learn to use a word processor. While that might seem like a trivial, even obvious, change from today's perspective, we should not underestimate the degree to which information technology enabled the faculty to transform the curriculum. The goals did not change, but almost everything else about the curriculum did change because of the new possibilities created by information technology. The second major change was the creation of the World Wide Web in the early 1990s.

Before I write about the curricular change, we should reflect on the circumstances of teaching composition in the mid 1980s. English 202 was offered at 18 campus locations and was staffed by several hundred faculty and teaching assistants. (The annual enrollment is about 8,000 students.) Very few of those teachers used a computer in the mid-1980s, and the eagerness to learn about technology was uneven. There was no systematic program for helping faculty to develop curricular materials or to learn to teach with technology. No program was available to teach students how to use a computer effectively. The university had very few computer labs and no classrooms with computers; LCD panels did not yet exist. The list of obstacles could be multiplied, but the point should be clear. Changing the curriculum and changing the pedagogy were separate but related challenges. As in every project to integrate computers into the curriculum, we were forced to make a number of decisions about where and how we expected students to use the computers, what our classrooms should look like, and how the initiative would affect the curriculum.

We wanted to change how writing was taught by using the computer in the writing classroom to appraise work in progress, to diagnose and revise problems on the spot, to present models or simulations of effective writing strategies, and so on. We envisioned computers helping our students by making various parts of the writing process easier. In particular, word processing would help students formulate ideas; select and arrange ideas more easily; and, especially, revise more easily. Spell checkers and other kinds of computer aids for analyzing texts could help with proofreading and editing.

Changing the curriculum and changing the pedagogy were separate but related challenges.

But the classroom was only one part of the package. The second major site of activity was in the instructors' offices. Everyone who taught English 202 received a computer. The instructors used those computers in three major ways. First, students who participated in student-teacher conferences took their drafts on disk to the meeting and worked on the paper with the teacher during the conference. This presented an important opportunity for the teacher to observe the student's writing process and to model more effective processes. Second, instructors used their office computers to prepare online materials to present in their classrooms. Third, faculty became increasingly inventive in developing, testing, and sharing course materials. Finally, some teachers used commenting programs to grade or give feedback on student drafts, which reduced time and effort in a highly labor-intensive course.

This version of English 202 remained quite stable between 1988 and 1994. The hardware and software were upgraded a couple of times, but the basic shape of the curriculum remained untouched. Assessment data disclosed very high student satisfaction with the course; faculty inside and outside the department noticed that students' writing had improved (though one might wonder whether the neatness of computer-produced drafts was a factor). Students were also satisfied with their new skills in creating and manipulating graphics, tables, and other visual materials. What dramatically changed these courses was the arrival of the World Wide Web in 1994. The Web ushered in a large number of new technologies to enhance communication between teachers and students. More than that, the Web dramatically increased the range of resources available to writers. An advanced writing student had easy access not only to the traditional print resources provided by the university libraries, but also to an ever-growing array of electronic resources. In addition, teachers and students could communicate easily outside class; nobody needed to carry disks to class any more. E-mail became a ubiquitous feature of all writing courses, significantly increasing the amount of written language that students produced. Faculty could also require students to publish their writing on the Web and could ask students to critique the working drafts outside class. Perhaps the most important impact was that Web publication enabled the students to join a worldwide community of readers and writers. Once again, the curriculum was altered by the assimilation and exploitation of new technology.

So where is English 202 headed? One new initiative is to create a version of the technical writing course that can be offered entirely over the Web. This version of the course would be attractive to students because it simplifies their class schedules; it also enables Penn State to offer the course through the World Campus (www.worldcampus.psu.edu) to students unable to attend a traditional resident class.

So what has been the life cycle of the English 202 curriculum? On paper, the course is the same today as it was in 1982, but as I have shown, it has undergone two dramatic changes at seven-year intervals. The instructional goals have remained the same, but the pedagogical resources have exploded dramatically. First in response to the personal computer and then in response to the Web, both teachers and students have new ways to gather information, communicate inside and outside class, and draw on an astonishing range of resources in developing and presenting their papers. In 1982, nobody could have anticipated either the ubiquity of the personal computer or the power of the Web to enhance teaching and learning. The official curriculum and the actual implementation exist at two different levels of reality.

I do not know what the landscape of higher education will be in 2007, and I can scarcely imagine what technologies will be available to enhance teaching and learning. My guess, though, is that the English Department will be an early adopter and early adapter of whatever is possible. Entrepreneurship now runs quite deep, and curricular experimentation is now an accepted part of the culture. One of the first beneficiaries of the English 202 initiative was the faculty in the modern languages.

The Language 3 Initiative: Curricular Change With Technology

The visibility and success of the English 202 initiative did not go unnoticed by other faculty. Indeed, modern language teachers also faced some of the challenges of teaching students to write well. In 1991, four department heads in Liberal Arts decided to propose jointly a collaborative effort to integrate technology into the teaching of French, German, Spanish, and Japanese. Following is the core of their proposal:

> Because of Penn State's recent investment in technology, almost all undergraduate programs have been able to benefit from student labs and innovative software. A striking exception is the modern languages, where Penn State is using the technology of the 1970s to teach students of the 1990s. Despite enormous advances in the past twenty years in second-language teaching, we have not yet tapped the full potential for accelerating learning by integrating technology in the classroom. At the same time that the faculty is calling for increased emphasis on international education and actively promoting an interest in "Other Cultures," the faculty who teach modern languages at University Park and the campuses have been unable to take advantage of quite startling innovations in second-language teaching. The "Language 3" proposal we present below will revolutionize the teaching of language.

Like the original proposal for English 202, the Language 3 Initiative did not propose to change the curricular goals; it sought to enhance learning. The goal was to create a language-rich environment that enabled students to interact meaningfully in the target language. By creating an internal consortium, the four departments could propose a sweeping curricular enhancement that none of them could hope to achieve by itself.

Like the English 202 initiative, the project had several phases. New kinds of learning spaces had to be created. The traditional model of the language lab (e.g., audiotapes or programmed learning exercises) had to be replaced by something quite new: classrooms that were especially designed to provide high-quality audio and video materials and student workstations that promoted collaboration and interaction with authentic language materials. Unlike the English 202 classrooms, which had only one computer each, the Language 3 classrooms were significantly different. Not only did these classrooms have an instructor's podium, they also had workstations for students, a stereo sound system, and a printer. The downside was that these classrooms could only be used one period per week, so three of the instructional hours were taught in a traditional classroom. The cost of creating enough classrooms to house all four class periods in a high-tech classroom would have made the project impossible to implement.

The greatest single challenge was deciding where and when to use technology in the curriculum.

The demolition of the traditional language lab and the construction of the new classrooms were the easy part. The challenge was to create a new kind of curriculum that would take advantage of software such as Système-D (www.heinle.com) and ToolBook (www.asymetrix.com) and new technologies such as the laser disk. The faculty soon found that changing one part of their program changed all parts of it; technology had a way of percolating into other courses (e.g., the upper-level literature courses) and into languages not originally part of the Language 3 consortium. Why not include Russian or Korean or Arabic as well? And if using a smart classroom one period per week makes good sense, would using it two periods per week make better sense? While these questions were worth grappling with, the greatest single challenge was deciding where and when to use technology in the curriculum. Obviously, because the technology changed—and faculty learned to make more effective use of it and publishers developed better materials to support the languages—faculty continually had to revise their syllabi. The enrichment of curricular resources led to higher expectations about students' learning the target language and about their enthusiasm. Multimedia, a much overused word, enriched all of the languages and completely eliminated the more traditional approach to teaching and learning. Good programs were made better.

But as Penn State learned in the English 202 initiative, once technology is integrated into the curriculum, the rapid changes in technology affect the design and delivery of curricular materials. To put it quite crudely, as technology goes, so goes the curriculum. But we should note that faculty embraced technology not for technology's sake but for its usefulness in supporting curricular aspirations. Thus, a technology-based project that began in 1991 was built around pre-Pentium computers. All of the faculty desktop computers were 486s; the operating system was Windows 3.1; the state-of-the-art technology was the laser disk; and ToolBook was the preferred authoring language. All of this changed with the advent of the Web in 1994. But, more important, faculty had learned that promoting student collaboration was easier to talk about than to accomplish and that the design of the classrooms significantly affected the kinds of collaboration they could promote. Indeed, the classrooms that had been designed with one kind of interaction in mind had to be changed to achieve another kind of student-teacher interaction. With strong support from the College of the Liberal Arts and central administration, new classrooms were constructed to reflect the technology and pedagogy that faculty sought. (For an update on the initiative, see www.la.psu.edu/lang3.)

The advent of the Web in 1994 affected the Language 3 Initiative even more dramatically than it had English 202. For the first time, it was feasible to have "live" audio and video materials streaming into the classroom and into student residence halls or apartments. For the first time it was easy and inexpensive to communicate electronically with native speakers throughout the world. Faculty could take advantage of other general tools for Web-based learning (e.g., conferencing, chat, news groups, Web sites) to enrich the curriculum. (For an example of how faculty are using new technologies such as NetMeeting, see cac.psu.edu/news/nlsu99/talkinglive.html.) As this chapter goes to press, the faculty who teach Spanish have embarked on an ambitious program to substitute Web-based instructional materials for part of the traditional classroom experience. Because of the successful experience with Language 3, a cadre of faculty and administrators are able to explore very new models for achieving instructional goals.

Because technology was used throughout the university, the need for a Language 3 consortium was reduced. A new administrative structure was created in Penn State's Center for Language Acquisition: Technology Enhanced Language Learning (TELL). This initiative invited all language departments to participate in its programs. (For more information about this initiative, go to beetle.la.psu.edu/tell.) A common element in the TELL initiative is the central role of technology, and so it is not surprising that faculty associated with TELL are exploring the possible uses of a laptop classroom, a design that nobody could have imagined in 1991 or in 1996. Since technology has become so tightly integrated into the design and delivery of curricula, it is no longer seen as an innovation. It is simply part of the instructional tool kit. Changes in technology (e.g., the move from non-networked instructional modules to Web-based materials) accelerate the speed with which curricula can be developed and delivered. The life cycle of the curriculum, at least in the languages, has been shortened.

As with English 202, the Language 3 Initiative has changed the curriculum without changing the educational objectives. It has seen technology move from the periphery to the center of the instructional program. It has benefited from the enrichment of the technology infrastructure and the globalization of Web-based resources. And it has avoided being trapped by paradigms that no longer work. Like the traditional audiovisual language lab and the drill-to-kill model of rote memorization, Language 3 has evolved and adapted to a rapidly changing world.

If these two projects in the humanities seem similar, it is because they were implemented at the level of single courses, either in a single department or within a small group of similar departments (all of which happened to have offices in the same building). What happens if you intend to create an entirely new curriculum at the same time you are creating a new college or school? The approach has to be completely different.

IST: Continuous Curricular Development

The curriculum for Penn State's newest academic unit, the School of Information Sciences and Technology (IST), provides a case study of designing courses and curricula that will deliberately have a relatively brief life. This new school (www.ist.psu.edu) was created in 1999 with the explicit goal of offering associate, baccalaureate, and graduate degrees within its first three years. It was charged with creating a curriculum that would not duplicate what traditional departments of computer science, computer engineering, or MIS already provide. More important, the curriculum should rapidly adapt to the changing needs of information professionals and society. To put its mission another way, IST was charged with keeping its curriculum in step with the demands of business and government, which meant that the curriculum would need to be refreshed almost as soon as it was established. Such goals are easier to articulate than to achieve. What does this mean for the concept of life-cycle curricular planning?

First, it means that the concept of a course must always be dynamic. Many major software products have an 18-month cycle, and while it is too soon to say what the life cycle for an IST course will be, my guess is that the course materials will be continually refreshed. Second, the traditional notion of developing a course—that a faculty member is assigned to a course for which he or she develops the materials—has been replaced by the concept of a curricular team of faculty and support staff. IST 220, for instance, is one of the five core courses required for the baccalaureate degree. Its focus is on networking and telecommunications (www.ist.psu.edu/html/ist220.html), and students at any Penn State campus that offers IST courses can take it. How will the school of IST ensure that the curriculum for IST 220 is consistent from campus to campus and also remains current in its approach? The Web is necessary but not sufficient. Let me quote from an internal IST document that describes the approach to courseware development.

> The School of Information Sciences and Technology insists that collaborative learning be imbedded in all of its courses as a design principle. Further, to foster student involvement in their education, we require that problem-based learning be the overarching principle of course module delivery. In other words, a broad problem is posed. The problem may or may not be well posed. Student teams are formed. Teams must struggle with the problem definition, perhaps changing it. Then with the assistance of an instructor, the teams determine the educational resources required to solve the problem. Teams then work with the instructor, who assists them in learning new material from the resources that the instructor and the teams have determined to be useful. The entire effort is directed at solving the agreed upon defined problem. Teams present their solution to the class as a whole, where the class and the instructor provide constructive criticism. If the problem as defined is an overarching problem for the entire course, the solutions will be refined and be presented again. In other words, learning activities revolve around the problem(s).

A constructivist pedagogy underlies this approach to the curriculum, but just as important is a strategy for using technology to *teach* about technology. The course materials that a faculty team develops are housed in a database, which permits faculty to update materials easily, replace materials that are no longer useful, and to assemble cases quickly and effectively. A team of instructional designers and media specialists help sequence and illustrate the key concepts that underlie the cases, and all of the courses require careful assessment of educational outcomes.

Unlike English 202, the content of which has been stable for nearly 20 years, the IST courses will change rapidly both in scope and content. Will IST need a minor in e-commerce or a series of courses in bioinformatics? The modularization of educational materials invites such an approach. Because the school is so new, it does not carry the baggage of institutional inertia. The faculty are committed to continuous curricular change, and they have seized the opportunity provided by databases and the Web to ensure that course materials can be shared and enriched quickly and easily. Given this approach, however, how can we talk about the life cycle of a curriculum that will continually be revised? It might be accurate to think of individual courses as version 1, version 2, and version 3, much like the software that students and faculty encounter. The school of IST has very clear expectations for its students' development; the written curriculum documents are road maps. The real curriculum is being instantiated both in the processes of developing and delivering courses (some face-to-face and some online) and in the course materials themselves, which will frequently be refreshed by new cases, problems, and scenarios. It is only a slight exaggeration to say that, unlike the English 202 and Language 3 curricula, the IST curriculum will always be emerging from and responding to the challenges of current problems.

Technology has become so tightly integrated into the design and delivery of curricula; it is no longer an innovation.

Summary

One of the hoary jokes about higher education is that some courses never change because the faculty use the same yellowed, dog-eared lecture notes year after year. I have no way of guessing how common such practices might be today. But there was a time when such practices were normative. When I was doing research at Cambridge University a few years ago, I studied educational practices at that university during the 16th and 17th centuries. I looked at many students' notebooks—students were supposed to write their recollections of lectures outside class because note taking was not allowed. For courses like rhetoric and logic, I saw virtually the same notes from decade to decade. In some cases, a father passed his notebook to a son, who only lightly altered the notes. Such an approach to learning was possible only if the curriculum itself was unchanged or if the faculty were unwilling to change it. Such an approach to a curriculum relied on and perpetuated traditional modes of learning. Knowledge itself was fixed, timeless, stable.

Today's universities have inherited some of the traditions of medieval universities; just look carefully at the academic regalia on display at graduation ceremonies. However, now they are driven by new kinds of pressures. The expectations of students, parents, and employers have changed markedly over the past few decades. The emergence of online courses and for-profit universities has changed the landscape of higher education. The claims for curricular relevance and timeliness are only thinly veiled appeals in much of the promotional materials that colleges and universities send out. Institutions such as St. John's College (www.sjca.edu) can establish a market niche by *not* changing their curricula: what they offer is a timeless Great Books curriculum. What is St. John's motto? "Where great books are the teachers." But most other universities are replaying the Penn State scenarios that I have described above. The pressures for curricular reform will affect both the design and implementation of individual courses, but the larger issue is what the collection of courses that we call a baccalaureate degree actually achieves. Does the undergraduate degree need to take four years? Why? How can universities enrich the curriculum through concepts such as "public scholarship" or "service learning" or "active learning" components? What are the right time and the right way to include team-based activities? What is the right mix of face-to-face and online learning activities? How do we assess learning outcomes more skillfully?

This list of questions could be endlessly multiplied, and no single answer will suffice. But to the extent that faculty and administrators are addressing these questions, the life cycle of any curriculum they develop is likely to shorten.

Part 3

Supporting the Vision: The Campus Digital Plant

The rapid emergence and convergence of digital technologies (e.g., high-speed networking, wireless communications, multimedia applications) are causing us to sharpen our focus on the role and effects of technology in higher education. For purposes of this book, we believe it is useful to use the concept of the "digital plant" to capture our new focus. The challenges of the new and expanding technologies include how to coordinate them, how to fund them, how to organize them, and how to use them to the ultimate end of meeting institutional goals.

We introduce the concept of the campus digital plant because it incorporates many of the major sources of change, challenge, and chaos-–and presents major economic impacts. The technologies that drive planning today do not observe traditional boundaries; rather, they now blur many previously defined roles, including economic boundaries. Our authors use the term "information technology," or "IT," to describe their organizations and the changes resulting from their efforts. The term "digital plant" conveys a comprehensive way of thinking about the combined IT projects and resources that are needed to support a Web-enabled campus.

The Physical and Digital Plants

The physical plant, among the most understood and well defined parts of colleges and universities, includes buildings, infrastructure (water, electrical, sewers, sidewalks, lawns), building systems (heating, ventilating, air conditioning), classrooms, laboratories, and libraries. In the past, technology-based changes were often added incrementally to the physical plant. These changes involved communication systems (which not so long ago were owned by the local telephone company and added without initial cost to university buildings), mainframe computers in air-conditioned rooms, and computer laboratories (with several monitors and keyboards and specialized printers to access those computers). Technology in classrooms often included a television monitor and several specialized projectors. Changes to classrooms often were limited to upgrading to newer versions of these primitive systems.

The physical plant is defined by its physical site and characteristics. We know where it is, how it is used, what its operational costs are, and when it operates. A physical plant in use from 8 AM to 10 PM is considered effectively utilized. Life-cycle costs of buildings and equipment are understood, if not provided (such costs are so often avoided or postponed that colleges and universities have developed the term "deferred maintenance" to describe a portion of the postponed costs), and depreciation is an arithmetic process. The planning that affects the physical plant has been, similarly, linear and predictable.

Our increasing reliance on digital technologies and the rate at which they are emerging and converging are confounding the boundaries and definitions of the physical plant. In fact, the communication technologies that have become so pervasive in higher education transcend the physical plant, creating a whole new infrastructure of virtual and physical spaces and services with a different class of uses and characteristics. This new set of spaces, services, and applications is the digital plant. Unlike the physical boundaries and limitations of the physical plant, the digital plant is defined not only by its spaces and services, but by how, when, and where it is used—generally 24 hours a day, seven days a week. Planning for the digital plant requires not only more flexibility, but new insights and tools for feedback and accountability. Planning tools suitable for the physical plant are not generally suitable for the digital plant.

The portion of faculty effort that makes use of technology in instruction and research (in its wide range of skills and applications) is also part of the digital plant. Staff support of the digital infrastructure is an integral part of the digital plant. In short, the digital plant has grown into a major enterprise in most institutions. However, in many—if not most—institutions, it has not yet become a formal, systematic organizational element in the institution's planning and budgeting processes. Life-cycle considerations and funding are among the most vexing problems as these new technologies are implemented in higher education. Authors in this section provide lessons from their considerable experience. This experience can help readers move more quickly to solutions in their own settings and situations.

We include in the digital plant the following elements and characteristics:

- Communication and computing tools at all levels, from enterprise to departments, to dedicated servers, desktops, laptops, hand-held appliances, and telephones
- Software and applications, purchased and developed internally, including delivery systems and Web tools
- Network/communication infrastructure, wired and wireless
- Databases, including the electronic portion of libraries
- Classrooms and instructional labs equipped with digital capabilities
- Staff, including managers, programmers, systems developers, and media services support personnel
- Faculty development programs (those intended to build technology skills, support the transition of current curricula to new curricula, and convert traditional lecture formats to digital curricula)
- Operations that occur seven days a week, 24 hours a day

Through the early 1990s, mechanical and analog systems of the physical plant dominated the available tools for operations, maintenance, design, and construction of physical spaces and facilities. Predictability and structure lent themselves to planning and organization by traditional facilities managers. As mechanical and analog systems have given way to digital systems, the universe of options available to students, faculty, and institutions has increased substantially. The institution's well-defined plans and control mechanisms no longer cover the options available to the education process. In Part 3 we have the benefit of authors who focus on broader visions and increased accountability as means of managing resources and outcomes.

Chapter 1 notes that old planning paradigms no longer work. While most of us can understand those notions conceptually, we may wonder why. Innovations in technology have disrupted planning's focus on control and organization. Our earlier ability to manage planning processes in a predictable way has given way to the need for more flexibility and a greater array of planning processes and tools. These changes—largely driven by technology advances—have also, paradoxically, increased the need for planning and the accountability for the use of resources. Earlier chapters in this book remind us that uncertainty in the future requires a greater certainty in basic visions and values.

The chapters in Part 3 describe metrics for planning, funding, and operating the digital plant and making that broadly defined infrastructure work for the institution. These chapters show how critical assessment and measurement are in achieving goals.

Chapter 10 by Christopher S. Peebles, "Life-Cycle Costs: More Than the Cost of Hardware," provides a comprehensive look at a large, modern IT support unit at a leading research institution. In many respects this organization serves as the hub of a modern IT digital plant infrastructure that effectively manages staff and delivers services across a large, distributed geographical structure. This chapter illustrates well how culture, structure, and mission in higher education are integrated with successful IT advances.

Peebles also describes how the Balanced Scorecard, a concept developed by two Harvard Business School professors, can be applied to IT organizations in higher education. Among the critical elements of the scorecard is assessment. This is not pie in the sky. Peebles provides specific Web site references and scorecard results for his organization. His so-called "sense and respond" model, coupled with assessment and activity-based costing, is the basis of ensuring close-to-the-customer services that match customers' needs and expectations. This model provides campus managers with a means for assessing where they will most effectively serve customers with available institutional resources.

Chapter 9, "Planning for IT in Higher Education: It's Not an Oxymoron," by John W. McCredie, provides planning and managing guidance for IT units even when an institutional vision may not be comprehensive. McCredie encourages IT leadership to be a part of, and even provide the catalyst for, the development of the critically important broad vision for IT. He outlines the major challenges facing IT organizations, including decentralization of IT, inconsistent internal economy, resource mismatches (of campus budgets and IT requirements), uneven use of educational technology, emerging digital libraries, aging administrative infrastructure, and retention of IT professionals. He then outlines methods and strategies for responding to these challenges.

McCredie introduces the concept of strategy formation life cycles, in which IT planning is recommended at different timing cycles, such as quarterly and annually. He also recommends a longer time horizon, such as five years, to provide direction and a sense of stability. IT managers and campus leaders interested in planning and organizing the IT enterprise can benefit from this particular perspective. He describes his views as follows: "The perspective [of chapter 9] is not one of a professional planner but that of an IT manager who has learned important lessons deep in the trenches of both public and private computing and communications organizations."

In chapter 11, "Virginia Tech Faculty Development Institute," John F. Moore and J. Thomas Head describe a faculty development process and program at Virginia Polytechnic Institute and State University in which faculty are invited to enhance their use of instructional technology and in which 95 percent of the faculty have participated. They also describe a process in which the life-cycle costs of implementing the faculty development element of the digital plant are built into the budget.

The Virginia Tech experience Moore and Head describe is a presentation of a systematic and long-term program. They discuss three life cycles of faculty development activity since 1992 and the issues that arose as they went through each cycle. Literature searches do not reveal examples of faculty development in which three cycles have been completed and documented.

Paying for the digital plant is an issue discussed in several parts of this book. Chapters 5, 6, 9, 10, 12, and 14 each provide a perspective on this basic issue. Chapters 5 and 6 describe plans that made student computer ownership a valuable and required part of the educational experience. Chapter 9 discusses the financial areas that require clarification. Chapter 10 provides metrics and tools for projecting the costs of sustaining many elements of the digital plant. Chapter 12 describes strategies for managing costs for infrastructure by assuring that formal participation of technology experts is a standard element in facilities planning. And chapter 14 notes how "budget dust" is no longer sufficient as a source of revenue for mainstream campus activities.

Observers of new technologies tend either to dismiss them or to overestimate their effects. One needs only to consider the projections of the paperless office to realize that television or the Web will not replace the university. That projection is too extreme, but the inexorable changes and increased competition resulting from the use of new technologies are likely to leave the inattentive on the slag heap. These chapters provide perspective and the definition that administrators, faculty, and staff can use as they respond to new demands and technology.

Also included in Part 3 are two planning practices that show how institutions are trying to overcome some of the challenges identified in the chapters. Martin Ringle describes how Reed College is working to overcome part of "The IT Staffing Puzzle" by using a recent graduate apprentice program. In "Community-Based Planning for Technology," R. Dan Walleri of Mt. Hood Community College describes how industry and education are collaborating to do community-based planning for technology in hopes of reducing duplication and increasing the speed of change to meet community training needs.

Although these chapters discuss technologies and their effect on planning, the lessons are about people and how they envision the process of change and bring about change through effective planning and visioning. The technologies are putting increasing pressure on institutional resources for the digital plant and requiring trade-offs that might have been deferred for the physical plant. These chapters address the interplay among the institutions' leaders, the dynamics of technologies, and resource requirements imposed by the increasingly short life cycles of the technologies.

John W. McCredie

9

Planning for IT in Higher Education: It's Not an Oxymoron

John W. McCredie is the associate vice chancellor, Information Technology, and chief information officer at the University of California, Berkeley. He is responsible for leading all central computing and communications activities, including the campus data and voice network and support for academic, administrative, and outreach programs. Previously he directed the External Research Program at Digital Equipment Corporation, and before that he served as president of EDUCOM and vice provost for computing and planning at Carnegie Mellon University.

Introduction

Seventeen tumultuous years have passed since the author of this chapter edited *Campus Computing Strategies* (McCredie 1983), the monograph that initiated the EDUCOM Strategies Series on Information Technology. In 1983, planners on the 10 campuses involved in the EDUCOM project did not foresee the Web or the tremendous growth of electronic commerce in their future. Nor did they recognize the influence that Microsoft would soon exert over every aspect of their environments. Few knew that four employees had incorporated earlier that year to form SUN Microsystems, and fewer still would have predicted that Digital Equipment Corporation (DEC) would no longer exist as an independent corporation in 1998.

Do these observations imply that strategic planning for information technology may be futile? If we cannot see the future clearly and if technology continues to move at such an incredibly fast pace, is it worth the frustration and significant investment required to develop strategic IT plans in higher education? Martin Ringle and Daniel Updegrove (1998) posed similar questions in their award-winning *CAUSE/EFFECT* article, "Is Strategic Planning for Technology an Oxymoron?" The answer to these questions is that strategic planning is certainly not an oxymoron. Whether or not your parent institution engages in strategic planning efforts, an ongoing IT strategy formulation cycle is necessary if your college or university is to remain competitive in every respect.

Colleges and universities are responsible for transmitting humanity's accumulated wisdom and knowledge to the next generation—expanding the knowledge base, teaching about it, distributing it as widely as possible, and preserving it. The central, and ever-expanding, role for information technologies in these endeavors creates an imperative for each higher education institution to formulate appropriate strategies for developing a rich set of integrated information services that are tailored to its unique educational environment.

The Web, the Internet, and ubiquitous personal computing and communication devices have already changed the way people throughout the world gain access to information and interact with one another. These technologies are changing how we learn, do research, manage our activities, reach out to others, and even have fun. Planners and IT professionals may speculate about the revolutionary effects these advances will spawn during the coming decades, but we will probably underestimate the actual impacts. We will almost certainly misjudge the timing of significant changes. Specifically, planning efforts today are not likely to predict exactly when and how emerging high-performance networks such as Internet2, pervasive wireless personal digital assistants, or campus portals will actually change higher education or society at large in the decades to come.

Despite these unknowns, a well-organized IT strategic planning process can (a) reveal the fundamental direction in which an organization should move, (b) identify key strategies for energizing this movement, (c) clarify the actions needed to help departments and the college or university achieve their broader mission and goals, and (d) articulate what leadership and services the campus can expect from the IT organization.

An effective IT planning process helps leaders determine the appropriate roles for information technology in learning and teaching, research, outreach, and management and predict how these roles might change over time. A well-designed planning process enables the IT organization and other campus departments to develop a shared understanding of how technology can and should support their specific programs. The process should include ways of communicating these strategies throughout the broad organization. Where should technology be introduced, and where should smoothly running processes be left alone? In short, the campus community should begin to understand what it means to become a *technologically wise organization.*

How should leaders articulate, communicate, and modify the planning process as technology, key managers, and the organization itself change? How can they both guide day-to-day decision making and influence policy setting, resource allocation, and programs? How can the process become an integral part of an organization's infrastructure, not just a once-every-several-years mechanical event? What activities will help develop a shared understanding of the role of the IT organization throughout an institution's culture?

The intent of this chapter is to provide insights to help readers answer questions like these. The perspective is not one of a professional planner but that of an IT manager who has learned important lessons deep in the trenches of both public and private computing and communications organizations. The following observations and recommendations about developing successful strategies are not theoretical but practical and experiential in nature. These concepts apply to both large and small institutions in different stages of infrastructure development that are committed to plotting a successful course to the future.

Recommendations and Insights for IT Planners

Set a general direction and broad objectives rather than detailed action plans. A compelling direction and winning strategies, not detailed operational plans, should be the outcomes of a well-designed strategic planning process.

Many managers have unrealistic expectations for their strategic planning process. Others, having lost interest in the art of strategic planning as a result of lean budget years or frustrating experiences, no longer engage in formal strategy formulation at all. Instead, they focus on annual budget requests and short-term operational planning activities. Understanding the differences between strategic and operational planning, establishing realistic outcomes for each type of activity, and communicating the results of each are important ingredients for formulating both good long-term strategies and successful operational plans.

At the University of California, Berkeley, the Information Systems and Technology (IST) division is involved in an evolutionary planning process that combines important elements of strategic, operational, and budget planning. *Planning for Information Systems and Technology at UC Berkeley 1999–2003* is the organization's most recent strategic plan (IST Senior Staff 1999). *Administrative Systems Departmental Plan (1999) and Berkeley's Student Systems—Enhancements, Customization, and New Technology* (1999) are examples of yearly operational planning documents from two of IST's departments.

An explicit description of IST's focus for the next several years is a central element of the first document. The strategies outline what the organization will focus on, not the detailed plans of how it will accomplish these objectives. The strategic plan reflects customer input, describes what issues senior IST managers think are important, and emphasizes a flexible decision-making environment so that the organization can adapt to the rapidly changing world in which it exists. The intent of the planning process was to develop a framework to guide each member of the organization as he or she makes day-to-day decisions.

The other two documents are examples of annual operational plans. From them, any reader can learn what the department proposes to accomplish in the short-term and, perhaps even more important, what projects are not currently on the priority list. During the budget process, unit directors translate these documents into specific budget proposals that inform their resource-allocation decisions.

In "The Fall and Rise of Strategic Planning," Henry Mintzberg (1994) describes this important difference between strategy formulation and operational planning.

> When companies understand the difference between planning and strategic thinking, they can get back to what the strategy-making process should be: capturing what the manager learns from all sources (both the soft insights from his or her personal experiences and the experiences of others throughout the organization...) and then synthesizing that learning into a vision of the direction that the business should pursue. (107)

Mintzberg continues by making the important point that the most successful strategies are visions, not detailed plans. Later in the article, he observes that "sometimes strategies must be left as broad visions, not precisely articulated, to adapt to a changing environment" (112).

One example of an important strategy is the IT organization's decision regarding its campus leadership role in the use of information technology. Making this decision explicit has a great deal of value. On one end of the spectrum of options is the concept of the IT organization as a rather narrowly focused production utility that can be counted on to deliver the payroll, grades, and voice and data dial tone. On the other end of the spectrum is an entity that coordinates all campus IT initiatives and represents the interests of most IT support staff. An important result of UC Berkeley's recent planning process was the development and communication of IST's strategy about where on this continuum it plans to be. IST is actively taking the lead to solve several important campuswide problems, not simply as a large division with a vested interest in technology but as a major catalyst for campuswide discussions, decision, and actions. Whenever possible, IST plans to represent the broad interests of the campus IT community at the highest levels of discussion. This decision will drive ongoing budget and operational planning processes regarding such key services as Internet2, CalREN-2, educational technology support, outreach to K–12 communities, and new financial and human resource management systems.

Accept the cyclic nature of the strategy formulation process. Strategic planning is not a one-shot activity. If thought of as strategy formulation, it can become an integrated part of the entire process of leading and managing a complex organization. Just like the budget, performance review, and appraisal processes, strategy formulation is one of the ongoing responsibilities of the management team. The frequency of formal strategic planning cycles, however, is likely to be much less than more routine operational functions.

A compelling direction and winning strategies, not detailed operational plans, should be the outcomes of a well-designed strategic planning process.

While other processes occur monthly or quarterly, both the frequency and the time horizon for a strategic IT planning effort should probably be a few years. A five-year cycle seems to be a convenient time horizon for many organizations. What is important is developing strategies with multiyear viability to give direction and a sense of stability to the organization. Managers should review, evaluate, and possibly modify these strategies on a much more frequent basis as the environment changes.

Often the impetus to begin a formal set of planning activities comes from an external source—a new chancellor or president, a new leader of the IT organization, recommendations from a governing board, or a broad planning initiative in the parent institution. At other times, the impetus comes from within—a significant opportunity or challenge, a structural reorganization, or the realization that the results of the previous process are just not as relevant or as fresh as they need to be in the current environment. One of the responsibilities of a leader is to know when it is time to launch a planning process. When you sense that the time is right, do not be timid and do not wait for permission; launch the process.

Several events prompted IST's most recent strategic planning efforts—a new chancellor, a report with recommendations from a campus commission on educational technology, and the realization that it was time to take a fresh look at the IT division's mission, strategies, and objectives.

The IT management team at UC Berkeley developed the methodology illustrated in figure 9.1 to organize its overall planning framework. The processes described in the lower two boxes are ongoing monthly, quarterly, and annual events, while those in the upper two boxes occur on less frequent cycles or when the need arises. IST's values and internal and external communication processes are at the core of this planning paradigm. Values should be the most constant part of a culture. They remain stable even when strategies, projects, and personnel change.

The management team, working with external consultants, developed a set of measurement tools that are routinely used to assess how these values are being practiced on a day-to-day basis in our departments and in the overall division. One of these tools is a formal, anonymous organizational climate survey sent to every employee approximately every three years. Another tool is an ongoing informal self-assessment methodology used by most managers and departments approximately every year. At staff meetings, a quick and easy poll is taken to obtain metrics about progress, or lack thereof, in improving departmentally determined success factors. The factors that have improved least then become targets for special attention in the ensuing weeks and months.

In 1996, the digital convergence of voice and data communications technologies caused managers to review the structure of the IST division. They decided that a few important changes were in order to achieve the goals developed in the 1992–93 strategic planning cycle. The most significant change IST made in 1996 was to merge the voice and data communication departments into a unit called Communication and Network Services so that IST could take advantage of the technological convergence that was clearly on the horizon. This realignment of core services was a direct result of the emphasis on network development identified in the prior strategic planning cycle.

IST's overarching strategies—providing IT leadership, building the IT infrastructure, and expanding IT technical support—guide the annual operational planning and budgeting cycles for the division's interdependent departments. Managers relate each individual project proposal and budget request back to one or more of

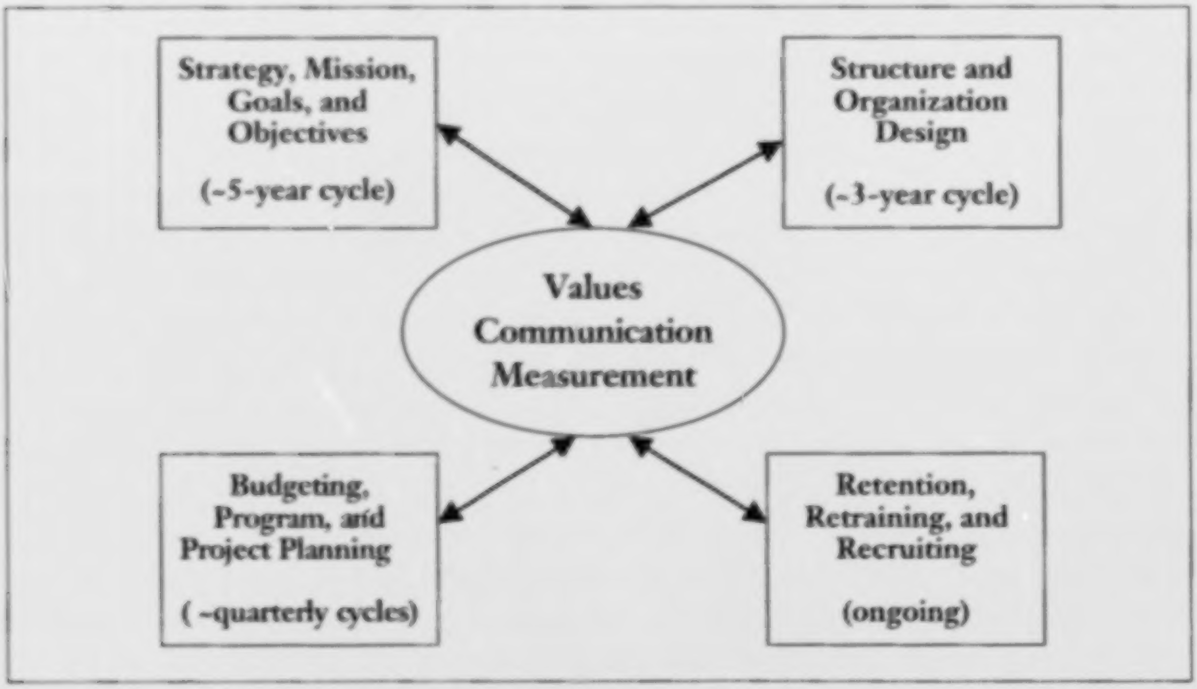
Strategy, Mission, Goals, and Objectives
(~5-year cycle)
Structure and Organization Design
(~3-year cycle)
Values
Communication
Measurement
Budgeting, Program, and Project Planning
(~quarterly cycles)
Retention, Retraining, and Recruiting
(ongoing)

Figure 9.1 University of California, Berkeley's Cyclic Planning Methodology

the broad strategies before the overall budget is submitted to the university administration.

The most important concept in this overall approach is that all five elements represented in figure 9.1 are interdependent and must receive explicit management attention. Values, frequent and clear communication, and measurement and assessment belong at the heart of the planning and management cycle. The other processes are cornerstones, or building blocks, that work together to create the overall strategic planning environment.

It is not practical to work on all five activities in parallel. In one year, strategy formulation may take precedence while, in the next year, managers may concentrate on organizational development issues. Although the time frames vary for each part of the process, every member of the management team understands that these responsibilities are part of his or her job and that it is valid to question "when," but not "whether," the next strategy formulation cycle should begin.

Focus on the major challenges. Strategic planning textbooks contain suggestions to guide the development of planning processes tailored for almost every organizational culture imaginable. For example, there are many variations of the SWOT analysis in which managers evaluate an organization's strengths, weaknesses, opportunities, and threats. Another technique that has worked well in several different settings is to have the planning team agree on the most important major challenges facing the department and its parent organization.

Some of these challenges currently may be outside the responsibility of the planning organization, but that observation alone can lead to interesting strategies. Not every challenge needs to be tackled in the planning process, but a comprehensive list will generate a great deal of productive discussion, help everyone understand what is going on in other areas of the campus, and contribute to the important task of setting priorities. In its recent planning process, IST recognized the following issues facing the UC Berkeley campus as a whole and IST in particular.

- *Decentralization of IT.* At most institutions, there is a great deal of ambiguity about the appropriate relationship between the central IT organization and decentralized IT operations in departments, colleges, and other divisions. For example, the tendency to distribute responsibilities for planning, budgeting, and system architecture decisions to autonomous local units is often in conflict with the desire for coordinated budgeting and planning, common databases and procedures, and overall system compatibility and security. These complementary, albeit sometimes competing, relationships need to be rationalized, made explicit, and communicated.
- *Inconsistent internal economy.* What resources should be provided at no cost to all members of the campus community? What services should individuals and departments pay for? For services that are subsidized, how can central funding be scaled so that supply can match demand? For the past several years at UC Berkeley, many data networking services have been provided at no charge while traditional voice services are provided on a fee-for-service basis. Although the two units providing these services have merged, their resource-allocation and cost-recovery methods have been separate. As most communication services become digitized and integrated, IT organizations must develop a rational internal economy for their services. IST is working with a campuswide, scalable, network funding task force to implement a network-funding model that will place market incentives on departments and end users while retaining a strategic central funding role to upgrade the core infrastructure.
- *Resource mismatch.* Campus budgets are relatively fixed, but demands for information resources continue to expand rapidly. Campus departments need significantly more technical support than they now have. To attract and retain the best researchers, teachers, students, and administrative staff, colleges and universities must offer a competitive information services environment. To invest in new technologies, strategies are needed to reallocate existing resources or to develop additional resources.
- *Uneven educational technology.* Faculty, students, and staff are increasingly integrating educational technology resources into all aspects of teaching and learning. However, campus leadership and

responsibility for educational technology and academic computing are often unclear. Frequently, existing services are not well coordinated and are difficult to locate and access. In addition, resources are usually unevenly distributed among disciplines, and "have-not" departments have trouble experimenting with new applications.

- *Emerging digital libraries.* Higher education faces the enormous challenge of integrating the classic paper-and-artifact-based systems of libraries and museums with emerging electronic systems for authoring, ownership, publication, storage, delivery, and retrieval. Many libraries have projects under way to explore the new challenges and opportunities of electronic scholarly information resources. Effective partnerships among libraries, museums, and IT organizations need to be developed.
- *Aging administrative infrastructure.* Most campus departments want improved systems for managing their operations, but campus responsibilities for developing and maintaining new departmental systems are often not clear. As a result, there are often gaps or overlaps in developmental services. The growing complexity of many of these systems makes the cost of campuswide implementations very large. Questions to be addressed include: Which systems should be developed and coordinated campuswide? Which should be outsourced? Which should be decentralized?
- *Retaining, recruiting, and retraining IT professionals.* Most colleges and universities have significant problems retaining and recruiting the skilled set of IT professionals needed to reach their goals. Some approaches to this problem include retraining existing staff, convincing graduating students to remain at their alma mater for several years in a professional capacity, and becoming more innovative and aggressive with compensation packages.

Another often-used device (like SWOT) in the planning literature is the observation that the Chinese word and pictograph for crisis (or major challenge), "wei ji," is a combination of two words, the first meaning danger, or threat, and the second meaning opportunity. Each of the issues noted above is now part of the UC Berkeley planning cycle as IST develops strategies for meeting these challenges and turning them into opportunities.

Do not concentrate on predicting specific technological outcomes. Information technology is evolving too quickly for planners and managers to make detailed and accurate technology predictions several years in advance. Like weather forecasts, the track record for predicting technology improves with shorter time horizons. However, several consulting firms predict specific technological outcomes with varying degrees of success. As the following forecast illustrates, the GartnerGroup handles the inherent uncertainty in the process by giving probability weights to its forecasts: "By 2001, 2.5-inch HDDs will be widely adopted for fast-disk applications on Unix and NT servers (.7 probability)" (Casey 1998).

Specific technical outcomes, such as the one in this example, are difficult to forecast accurately, and, in fact, are really not crucial to strategic planning activities. Many general trends, however, are stable and much better understood. Moore's Law, which quantitatively describes the astonishing rate at which microelectronic chips continue to improve, is a good example (Moore 1979). In the 1960s Moore predicted that the number of transistors on a chip would double every 18 months. More than 30 years later this forecast continues to be accurate, and an important consequence of Moore's Law is the continuing increase in performance and decrease in price of computing and communication systems. Although it is difficult to predict what specific systems and applications will emerge in the next few years because of Moore's Law, the general trends are crystal clear. However, a significant question remains for strategic planning—when will the improvement rates predicted by this "law" slow down because it is no longer valid?

Short-term technical predictions are important when deciding on the tactics of a particular project and its related budget and operational plans. The strategy formulation process depends instead on long-term technological and organizational directions that are more likely to remain stable over the life of the plan. Concentrate on understanding these longer-term trends and build your strategies around them.

Engage a wide range of staff and constituents in the process. Strategies are not likely to have a significant influence throughout an organization if the processes that spawned them were not open and inclusive. Plans developed by a small, select group and delivered to a broad organization as if they were cast in stone will probably not have the buy-in required to make them successful. Even if there is broad participation in several segments of the planning process from within an organization, outside departments, if they are not included in the discussions, may view the process as closed and may not accept, or even review, the results.

Strategic planning is not a one-shot activity.

The recipe for support of IT strategies includes broad participation in the strategy formulation process. Several managers involved in the 1998–99 IST planning process felt that it lasted too long, perhaps because the process included meetings with more than 20 campus focus groups. In retrospect, the energy invested in focus groups from the various campus constituencies was well spent and not the cause of excessive delays. It helped us hear what representative individuals were thinking and feeling.

One measure of success for a strategic planning process is the degree to which individuals throughout an organization, and in related departments, make day-to-day decisions that are influenced by the strategies developed in the process. They are much more likely to do so when they played a meaningful role in some part of the process. In addition, they are more likely to participate energetically in crucial implementation efforts.

Get professional facilitation, but never outsource the real work. The content of strategic plans should come from people deeply involved in an organization, not be imposed from an external source. People doing the work usually understand best what is effective and what needs changing. However, they do need support, time, and a physical environment conducive to thinking "outside the box," including ways to extend their knowledge of their customers' needs and to learn more about the requirements of the broader organization. To help make the process work well and stay on target, most groups need professional facilitation to achieve their full potential.

Since all groups bring their baggage to the planning process, a good facilitator will serve as a catalyst to help people move beyond their previous positions as they look to the future. He or she will ensure that everyone is involved and given a fair chance to present ideas without anyone exerting too great an influence. To accomplish this, the facilitator should be independent of the operational activities of the group and not have a vested interest in specific outcomes.

Another important function of the facilitator is to present accurate summaries to the group members about where they are in the process. For example: Is this the nth time a particular issue has come up without resolution? Is the group in a loop? Have they lost focus? Is everyone participating? Are proposed strategies articulate and easily understood?

The roles for other types of planning consultants are more controversial and the benefits less clear. Some consultants are selling a particular solution, not a planning process. The danger in working with them is that the desired result is known in advance and the engagement is focused on selling a particular answer rather than allowing individuals to search together for the right strategies for their specific organization. This approach can be effective, however, if the solution being marketed is indeed a good one for the organization *and* if its members are willing to accept it.

In higher education, the culture of most IT organizations is such that a "canned" set of strategies is less likely to be accepted than those that are developed by the organization itself. In any case, the broad leadership of the organization, not just a few managers, needs to be involved in the real work of formulating and then communicating the strategies that will carry the organization forward.

Move ahead even if your parent organization has no strategic plan or process. How can the IT organization make progress with a strategic planning effort if the rest of the college or university is not engaged in a similar process? If there is an overall plan or unified process, the path is clear and the IT organization should follow it. Its strategies then support the broader plan, and in the best of all worlds, they become an integral part of it. However, how should the IT organization proceed if such institutional plans are not well articulated?

Most large colleges and universities are made up of dozens of largely independent departments and schools that usually do not have an integrated long-range or strategic plan. The medical school, the business college, letters and sciences, fine arts, engineering, and many other academic units often operate in very different ways with different goals and objectives. This independence of departments and schools is certainly one of the distinguishing features of many higher education institutions. What holds them together can be found at a very high level—a commitment to a shared set of core values, even if not necessarily to a common plan.

Collecting stories is a good way to gain insights that are important in formulating strategies.

The culture of academic independence enables the IT organization to formulate its own strategies and long-range plans even when the parent organization does not have such plans. Since information technology is an integral part of the infrastructure supporting the operations of the entire institution, a major challenge in IT planning is to obtain the participation of other key departments in the overall IT plan. The other departments (and the overall institution) do not need to have their own plans, but they need to be included and involved in a planning process for information technology that supports the essential values of the parent organization.

Storytelling is an important communication tool. Let's face it—most planning documents are boring. Engaging high-level executives, technical staff, faculty, and students in a planning document where they have to wade through 20 or 30 pages of dry text about mission, goals, objectives, and performance metrics is not an easy task. However, engaging them in focus groups where they can learn from each other and share stories about both their frustrations with, and appreciation for, IT can work well. At UC Berkeley, we discovered that the focus group approach is much more effective in gathering input than sending out drafts of a plan and asking for suggestions, reactions, and recommendations. Often the feedback never arrives, or it becomes clear after several meetings where discussion of "the plan" is on the agenda that not everyone in the room has reviewed the draft documents prior to the meeting. Collecting stories through focus groups, e-mail, and so forth is a good way to gain insights that are important in formulating strategies.

Perhaps even more important is the role of stories, or scenarios, in the communication phase of the planning cycle. An excellent example of a compelling scenario is "The Electronic University" written by Robert Spinrad in 1983. Early in this article he makes the following observation:

> But my crystal ball is, alas, cloudy as to the *exact* shape of things to come. I have decided, therefore, to present my vision to you in the form of three vignettes: The Student, The Professor and The Administrator. These scenes are set in the very near future. (4)

The vision presented in this article remains compelling 17 years after it was written. Higher education has moved significantly closer to achieving many of Spinrad's predictions, but a great deal remains to be accomplished. In its 1993 plan, IST reprinted the Spinrad article and included two fresh vignettes written by IST managers who had the advantage of an additional decade of experiences. Stories like these bring the dry prose of planning documents to life. They are excellent communication vehicles for spreading important planning messages.

> Transforming a business plan from a list of bullet points into a story tells everyone not only what the goals are but also how to reach them.... Individuals in parts of 3M now use strategic narratives in their planning processes, not only to clarify the thinking behind their plans but also to capture the imagination and the excitement of the people in their organizations....By conveying a powerful impression of the process of winning, narrative plans can motivate and mobilize an entire organization. (Shaw, Brown, and Bromley 1998, 41)

Stay the course. Strategic planning activities can wear people, and organizations, out. Building winning strategies, reaching agreement on controversial issues, engaging the relevant constituencies, and communicating the status of the process on a regular basis all require a great deal of energy and discipline.

External events that require immediate attention are bound to occur during a planning cycle. Without discipline and dedication, short-term crises can derail longer-range planning. A maxim of organization theory is that tactical, unscheduled events can easily expand to fill all of the time available, thereby driving out the time available for long-term and strategic considerations. Without the support and involvement of top IT management, the strategy formulation process can grind to a halt or wither on the vine.

In the 1998–99 UC Berkeley planning process described earlier, the senior staff became bogged down and the process took a long time. The extended time frame of the project was more a result of distractions caused by too many other important activities happening in parallel with the planning process than of the decision to include many internal and external groups in valuable discussions. Although it was difficult to have the planning activities take so long to complete, it would have been an even greater mistake to abandon the planning process without reaching closure on several major issues.

Commit to a thorough and complete set of planning activities; stick to a realistic time schedule; modify the schedule when necessary; reenergize people when they get off the track; and above all, stay the course and complete the process so that strategic thinking and decision making actually occur.

Summary

Professor Emeritus Freeman Dyson of the Institute for Advanced Study in Princeton, New Jersey, proclaimed in the 1998 *Chautauqua Lecture* that "genetic engineering, solar power, and the Internet will be the three most important technologies of the coming century." Certainly information technologies are already transforming both society and higher education. The IBM PC was introduced only 19 years ago, the Apple Macintosh 16 years ago, the commercial commodity Internet about 10 years ago, and the Web about seven years ago.

Technologies fueling advances like these continue to emerge at breakneck speed. It is obvious that higher education's ability to incorporate these tools and realize their full potential is still in its infancy. Who can forecast accurately what effects these changes will bring? Perhaps Professor Dyson's crystal-ball gazing, looking a full century ahead, will not stand the test of time. However, the Internet and related technologies will certainly spawn some of the most important advances of the coming decade.

How will higher education adapt to an era of electronic commerce in which every person will have vast amounts of information available at the touch of a keyboard? High-quality distance learning, intelligent tutoring programs, electronic libraries, virtual classrooms, high bandwidth economical communication, and competition from for-profit corporations are applications that are right over the horizon. Clearly colleges and universities need creative thinkers at all levels to develop the winning strategies that will enable them to remain competitive throughout the transformation that has already begun.

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Many of the observations, ideas, and recommendations described in this chapter came from members of the IST senior staff and leadership team at UC Berkeley. These groups developed both a planning process and a plan that is serving our organization and the university well. I would like to thank every member of these teams for his and her insights and hard work. We hope that this chapter captures the essential features of our framework and that others may benefit from our learning process.

Christopher S. Peebles

10 Life-Cycle Costs: More Than the Cost of Hardware

> *Non-profit institutions tend not to give priority to performance and results. Yet performance and results are far more important—and far more difficult to measure and control—in the non-profit institution than in a business. (Drucker 1990, 107)*

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Introduction

Over the last decade, there have been massive changes in the culture, structure, and mission of information technology organizations that serve institutions of higher education. Today, services offered by these IT organizations go far beyond those offered to faculty and administrators in the not-too-distant past. No longer do computing center personnel divide the universe of IT customers into a few computationally savvy faculty and research students, a few score administrators, and a bunch of "dumb users." Today those "dumb users," who were neither "dumb" nor treated politely, have become valued customers, and the number of those customers who routinely use IT services has gone from a few to, in the case of the eight campuses of Indiana University, more than 150,000. Indiana's IT services have gone from a mainframe or two that supported massive, expensive, and repetitive calculations in the sciences and rudimentary automation of business processes to applications and network services that pervade and transform every aspect of teaching, learning, research, and the business practices in the university. Unfortunately, most of the software that provides these services has been written by programmers and sold by firms that still view their customers as "dumb users" (Minasi 2000). Despite utopian pronouncements, "Internet appliances" (read PCs) have not become as easy to use as toasters, typewriters, or telephones, at least not yet. As a result, support for customers in their use of IT has become as important and costly as the hardware and networks on which the applications run (Peebles and Antolovic 1999). Moreover, just as the hardware and software have life-cycle costs (depreciation and upgrades to the latest release), there are life-cycle costs for support of this hardware and these applications as well as life-cycle costs borne by those staff who provide support to the end users, e.g., end users' continuing education. All these costs must be calculated as a part of the life-cycle costs for IT services.

Strategic planning for IT reflects these changes in vision, goals, requirements, and expectations over the last decade (Katz and Rudy 1999). Requirements for adequate life-cycle financial support for hardware and software and for support of the faculty and students in their use of IT services are central to the best of these IT strategic plans. For example, the *Indiana University Information Technology Strategic Plan: Architecture for the 21st Century* (available at www.indiana.edu/~ovpit/strategic/) puts sound fiscal planning and life-cycle funding first among its 10 major recommendations. This plan, which draws on the intellectual resources of the entire university community—faculty, staff, students, and administrators from all departments and all eight campuses—envisions the continued development of a secure, productive metaphorical digital ecology for the university. It focuses on the services that transform, store, and transmit digital data and information that are essential "raw materials" for the creation of knowledge and the foundations for the development of understanding by members of the scholarly community, students and faculty alike. It sets goals for research and academic computing, network services, student computing services, administrative services, heightened security services, digital library resources, and a robust telecommunications service that will become a part of the wider, unitary digital data and video networks. At every point, this strategic plan emphasizes support for the users of IT—especially support for the faculty who integrate IT services in their course syllabi and their lectures. There are explicit requirements in this plan for assessment of the value that IT brings to the several missions of the university, especially in teaching and learning. Finally, this strategic plan implicitly embraces the six critical success factors outlined by Kaufman and Grisé (1995), especially their second rule that admonishes planners to focus on "what" and not on "how." Indiana's information technology strategic plan says what it wants to accomplish and delegates to the IT organization, in this case, University Information Technology Services (UITS), just how these services will be offered in pursuit of the goals that have been set.

Indiana and UITS–Structure, Culture, and the Balanced Scorecard

Indiana University comprises eight campuses, more than 92,000 students, 4,500 full-time faculty, and 9,500 appointed staff. It is a single university, not a university system, that embraces great breadth in its scholarly pursuits and great variety in its students. Indiana campuses are situated in almost every part of the state, from Gary, on Lake Michigan in the north, to New Albany, on the Ohio River in the south. The campuses include the residential, research I Bloomington campus; the urban campus in Indianapolis, which is classified as doctoral II and includes the medical, dental, and nursing schools as well as Purdue University schools of science and engineering; and the Indiana east campus, in New Albany, which carries a baccalaureate II classification and which, in the fall semester 1999, enrolled 2,253 full- and part-time students. UITS offers IT services on all of the university's eight campuses. UITS was formed in 1997 from the merger of the central university IT organization; University Computing Services, which also served the IT needs of the Bloomington campus; and Integrated Technologies on the Indianapolis campus. Today, UITS, which has approximately 500 full-time and 500 part-time (generally student) employees, offers networking services, library and administrative applications, research and academic computing, and computing support to the eight campuses. It also provides student computing on the Bloomington campus and some student computing and support on the Indianapolis campus.

The mission statement for UITS, which took its current form in 1992, is quite straightforward:

> UITS is committed to excellence in the delivery of information technology services and is dedicated to developing its staff members and empowering them to provide these services. UITS works with other members of its community to enable Indiana University to excel in teaching, learning, research, and service.

Perhaps the notable part of this statement is the emphasis on service. UITS is an organization that has the culture of service at its core. Its staff has the intellectual capital and technological expertise to produce these services. It asks only to be judged on the quality of the services it produces and not on the specific technology that it deploys.

UITS has been designed deliberately as a "sense-and-respond" organization (Bradley and Nolan 1998; Cortada and Hargraves 1999; Haeckel 1999). As Haeckel describes it:

> The sense-and-respond model provides a means for meeting the challenges of discontinuity. A sense-and-respond organization does not attempt to predict the future demand for its offerings. Instead it identifies changing customer needs and new business challenges *as they happen*, responding to them quickly and appropriately, before these new opportunities disappear and metamorphose into something else. Adaptability has come to be increasingly valued in recent years, and the terms

> *flexibility*, *agility*, and *responsiveness* crop up frequently in business discussions today. (Haeckel 1999, 3)

To meet the demands of responsive service, the individuals who make up UITS are deployed in small teams. Each team offers a service or set of closely related services, is responsible for the cost and quality of those services, and is charged with the management of the relationships with its customers. Examples of such teams run the gamut from a single person who manages Usenet news servers to 10 people who make up the messaging team, which manages e-mail systems and listservs, to the 30-person student information system team, which is responsible for both the legacy applications and the deployment of the new PeopleSoft system. This modular structure allows UITS to meet unanticipated demands for services, allows for the combination and recombination of individuals with particular skills to create new services, and provides a flexible career path for individuals within UITS. In one way or another, approximately 75 percent of the individuals in UITS have direct contact on a day-to-day basis with customers, and more than 30 percent of the organization directly supports faculty, students, and staff in their use of IT services. The goal has been to create a culture that thinks from the customer back to the organization rather than from the business to the customer; the goal is an organization that structures itself in terms of "…outcomes and commitments rather than activities and plans" (Haeckel 1999, 143). In a few words, service strategy determines organizational structure and a culture of service drives the strategy (11).

Despite utopian pronouncement, 'Internet appliances' have not become as easy to use as toasters, typewriters, or telephones.

The Balanced Scorecard in use. The elements of the Balanced Scorecard (Kaplan and Norton 1996; Kaplan and Cooper 1998) are routinely applied to the processes and products of UITS. The Balanced Scorecard focuses on four families of measures that are both retrospective measures of performance and prospective indicators of future needs and potential successes. Measures are taken of (1) customer perceptions, (2) financial performance, (3) learning and growth of the staff (increases in intellectual capital), and (4) internal business processes. Figure 10.1 outlines what UITS "attends to" on an ongoing basis. We measure all the resources that go into producing each service (the left-hand side of the figure) and look at the processes that go into combining resources and knowledge to produce particular services (the middle portion of the figure). We measure the cost and quality of each service we produce (the right-hand portion of the figure). These are, in fact, fairly straightforward measures, as the discussion below illustrates. UITS uses these measures to manage its affairs and services and as a basis to decide whether to decrease costs and increase quality of services. Finally, UITS uses these measures as the evidence necessary to eliminate services that have costs wildly at variance with their demand or value and to plan for new services that will be required in the near (measured in weeks or months) and far (measured in months or a year or two) future. The next series of paragraphs demonstrate this Balanced Scorecard in action.

Customer perceptions. The university has conducted a yearly survey of IT customers on the Bloomington campus since 1989 and on the Indianapolis campus since 1997. An adequate sample of users (adequate for computation of inferential statistics) are asked to rate each service on a 5-point scale, where 1 equals "awful" or "completely dissatisfied" and 5 equals "excellent" or "completely satisfied." A "percentage satisfied," which comprises the proportion that rated the service as "adequate," "good," or "excellent," is calculated for each service. A full report, from raw data and written comments to the analyses of these data, is placed on the Web for all to see (www.indiana.edu/~uitssur/survey/index.html). There are also daily surveys of customers who contact the support centers on the Indianapolis and Bloomington campuses (Peebles and Antolovic 1999; Peebles et al. 1999). Five randomly selected callers from each of seven distinct support lines ("Wintel," Apple, UNIX, e-mail, etc.) are sent an e-mail each day with the following three questions:

1. Did you receive an answer to your question or a solution to your problem?
2. Did you receive the response in a timely manner?
3. Were you treated with courtesy?

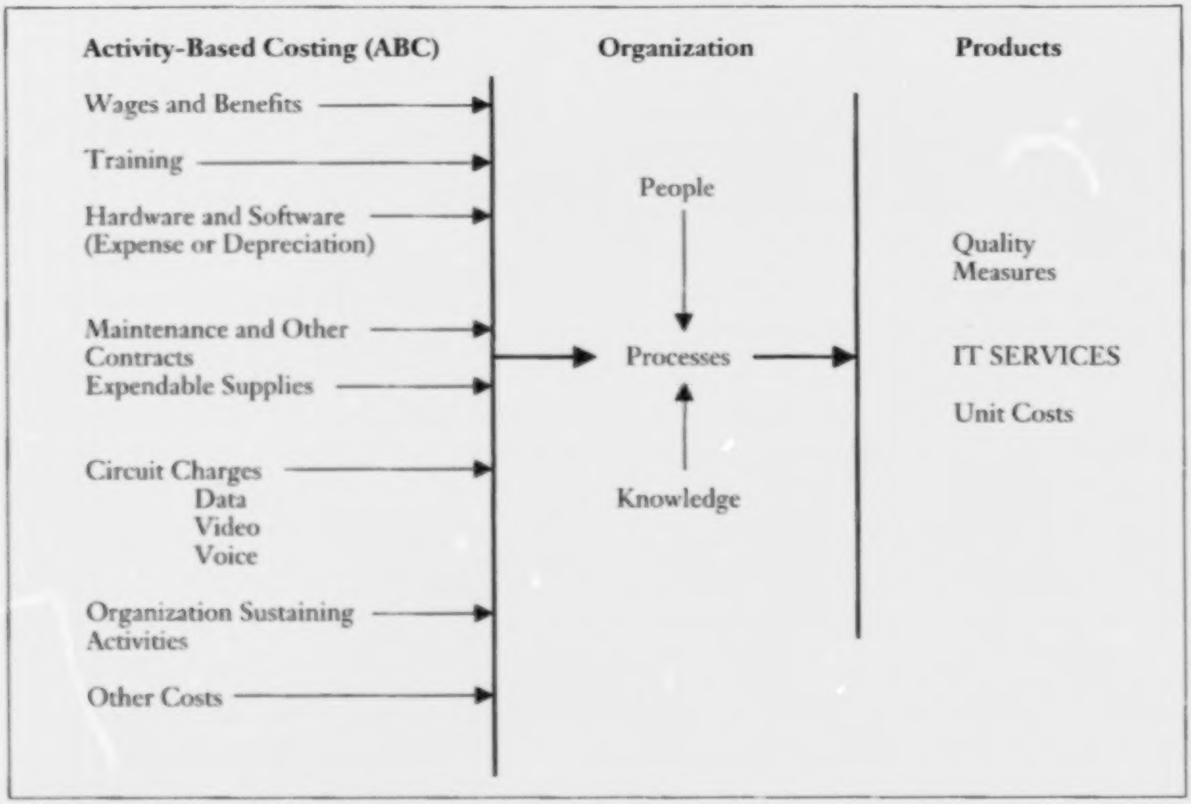
Activity-Based Costing (ABC)
Organization
Products
Wages and Benefits
Training
Hardware and Software (Expense or Depreciation)
Maintenance and Other Contracts
Expendable Supplies
Circuit Charges
Data
Video
Voice
Organization Sustaining Activities
Other Costs
People
Processes
Knowledge
Quality Measures
IT SERVICES
Unit Costs

Figure 10.1 Dimensions and Foundations of Cost and Quality Measures

The answers range from 90 percent "yes" for question 1 to 99 percent "yes" for question 3 (Peebles and Antolovic 1999, 48). These questions allow the support center to monitor its own commitment to customers and rapidly correct any deviation from fulfilling that commitment. Moreover, these questions, when coupled with the problem-tracking systems in the support center, can quickly point out failures in internal (UITS) and external (customer) training on systems that have been deployed recently. If there is a long lag in the time it takes to answer a question or if the answer given is either incorrect or unresponsive, there has been a failure in internal training. If the same question reoccurs repeatedly just after the deployment of a new application, there has been a failure in user training. In either case, the fault lies generally with UITS (and not the customer) and must be corrected internally.

Financial performance. Full activity-based costing (ABC) has been used to measure the costs of IT services on the Bloomington campus since 1995 and on the Indianapolis campus since 1998. "Activity-based cost systems…provide accurate information about the costs of activities and business processes, and the costs of individual products, services, and customers" (Kaplan and Cooper 1998, 19). When coupled with operational control and learning systems, these data can be used "to promote local efficiency and process improvements" (20).

In the case of UITS, as the left portion of figure 10.1 shows, the sources of costs for each service—such as people, equipment depreciation, networking, and supplies—are calculated, and then a proportion of the leadership costs, the "organization sustaining costs" (such as the office of the vice president, the finance office, or the human resources office) are added (Shank and Govindarajan 1993). Unit costs are then calculated and compared with previous years (internal benchmarking) and, where possible, with external benchmarking data. In the latter case, the "other costs" shown in figure 10.1 must be estimated. UITS is not billed for space and utilities by the university, so 13 percent of the total cost, which is the IT industry standard for space and utilities, must be added to the costs UITS publishes for external industry comparisons.

Like the quality measures, the ABC figures are published each year and are available at www.indiana.edu/~uits/business/scindex.html. In general, target ABC figures are constructed at the same time the budget is prepared. These estimates are compared against expenditures as the year goes by, and variances are noted and dealt with. Actual ABC figures for any year are available 60 to 120 days after the end of each fiscal year, which for Indiana ends on June 30. Once these ABC figures have been analyzed and used in process improvement and the major variances are explained to the satisfaction of all direct participants, they are published on the UITS Finance Office Web site, usually just after the beginning of the calendar year. Thus, at the time this chapter was written in December 1999, 1997–98 data were available on the Web, 1998–99 data had been reviewed and would be made available on the Web within 60 days, current-year estimates were in the hands of the managers and other relevant staff, and estimates (target costs and levels of service) for the next fiscal year (2000–01) were under construction. In the extended example of e-mail services that is offered below, these cost and operational data are the cornerstone of the process improvement and system reengineering project that is reported here.

Learning and growth of the staff. Learning and growth by members of the staff are the most effective responses to changes in technology, and continuing education is offered as an antidote to the half-life of knowledge necessary to offer these services. Each team manages its training but does so within broad guidelines set by the UITS leadership. For example, six integrated teams in the telecommunications division of UITS manage campus, regional, national (I2), and international (TransPAC) networks. Over the last decade, the network protocols they support have changed from SNA (IBM Systems Network Architecture); X.25, an archaic packet switched protocol; and DECNet (also a proprietary networking protocol) to Novell and Token Ring (whose half-lives are almost exhausted), TCP/IP, Gigabit Ethernet, ATM (asynchronous transfer mode), and Microsoft NT for LANs. In many cases, network engineers trained originally on SNA learned Novell and then retrained on NT. Others who managed campus Token Ring networks now manage Fast Ethernet networks. Similar, massive changes are under way as Indiana converts from legacy mainframe business applications to server-based applications with Web clients for their users.

UITS allocates $1,400 for travel and training and $1,000 for equipment for each full-time employee each year (these amounts equal approximately 6 percent of the UITS budget). Discretion over how these funds are spent is delegated to the managers of each team and the directors of each division. The only limit applied to their use is that the course or the meeting advance the professional IT skills of the person who requests them. These costs are a part of the life-cycle costs of particular IT services and are reflected in the ABC for these services.

The potential to gain additional skills and knowledge and the possibility of career advancement within UITS and within the university are a positive source of staff satisfaction and retention (which is vital in the current IT marketplace). Thus, these investments not only lead to improvements in service quality but also conserve the most valuable UITS asset, the people and their intellectual capital—their knowledge and their skills. Turnover among the full-time professional ranks is extremely low, less than 9 percent a year. In addition, many of those who leave UITS either stay within the university or return to UITS after a period in the for-profit world.

Internal business processes. Control and improvement of internal business processes requires constant effort. There are first-order considerations, such as how people—their knowledge and practices—and business processes are brought together to create IT services (see the center of figure 10.1). Prior to these factors, however, there must be some understanding of who requires the service, what the customers want and need, and what the institution requires of IT as a part of its mission. Once the market for the service is defined, measures for the quality and efficacy of the service can be constructed. As part of these estimates, there should be ways to measure the potential "cost of poor quality" when an application or some other bit of technology does not work the way it was designed to work. Certainly all those hours wasted trying to load a simple piece of software that, in the end, destroys the directory on the hard drive have to be accounted for somewhere. There are internal requirements that must be considered, especially when two teams must combine their products to produce the service that is ultimately delivered to the customer, e.g., the fit between an application on a server and a Web client. Then there is the matter of "change control" that cascades new requirements through the organization and ultimately reaches the customer. The best measures of "internal business processes" deal with the time it takes to deploy new services; the time spent to correct mistakes in the services offered; the "cost" the customer must bear to use new services or learn new versions of old software; and the ways in which partnerships are established with the faculty, staff, and students to improve existing services and to create new services.

If higher education is to realize the full value of investments in IT, it will have to contain the elements that destroy value.

Outcomes of the Balanced Scorecard. The measures gathered within the framework of the Balanced Scorecard provide information critical to the adaptive management of the IT enterprise. These measures, especially the cost and quality metrics, provide powerful, factual answers to those who demand accountability for the expenditure of public and private funds and who want to know if they received value for their money. When coupled with operational process measures, the elements in the Balanced Scorecard can result in activity-based management (Kaplan and Cooper 1998) and first-rate, responsive customer service. The only real dangers in adopting an approach such as the Balanced Scorecard are when measures proliferate, are given disproportionate weight, or become ends in themselves (Pfeffer and Sutton 2000, 139–75). If kept in perspective and combined with "softer" measures, such as cultural assessment (Schein 1999) and qualitative assessment of external partnerships with members of the scholarly community, a holistic approach to assessment is very valuable and productive.

The Hidden Costs of Support in Life-Cycle Funding

Between 1990 and 1996, Indiana President Myles Brand gave priority to life-cycle funding, which was completed for all the hardware and software that supported the central IT services on the Bloomington campus. The software and hardware included mainframes and servers, student computing facilities, network devices, telephone switches, and the wire plant. In turn, depreciation of these capital assets could be calculated and incorporated in the ABC for each service. Implementation of the current strategic plan, which began in 1997 under the leadership of Vice President and CIO Michael McRobbie, extends life-cycle funding to the desktop PC or workstation. The goal is to establish a three-year replacement cycle for all faculty and staff workstations throughout the university. This process, which must respect school and departmental budgetary control and the concept of responsibility-center management (which Indiana adopted in 1989), establishes dedicated accounts for life-cycle funding of IT equipment in each responsibility center—i.e., schools (such as nursing) and operating divisions (such as the bursar).

Periodically, the university has taken a census of existing desktop machines, servers, and peripherals. On the Bloomington campus in 1998, approximately 40 percent of the 4,400 machines were obsolete, and more would fall into this category within the next 12 months. The desktop machines on the Bloomington campus were separated into three functional categories: basic (such as word processing and surfing the Web); advanced (for using PhotoShop, scanning, and large spreadsheets and statistical work); and high-end (UNIX machines for scientific and artistic work). The university also counted the number of departmental servers and peripherals, such as printers. Current costs and viable life cycles were estimated for each category of computer and peripheral devices:

- Basic—$1,200 and three years
- Advanced—$2,000 and four years
- High-end—$5,000 and four years
- Servers—$8,000 and three years
- Printers—$2,500 and five years

The life-cycle costs, once all machines were brought up to the minimum standard, were $2.3 million each year; the average life-cycle cost for a machine each year, including peripherals and servers, was $1,000.

The cost of support in the schools and departments on the Bloomington campus can also be estimated closely with existing data. Over the last decade, the Bloomington campus has deployed a distributed IT support organization (Voss 1998). In this model, primary IT support personnel, dubbed local support providers or LSPs, are hired by schools and departments and are resident in the units they support. In turn, UITS provides these primary support providers, the LSPs, with specialized services and support, such as technology evaluation and planning, specialized hardware and software support, software distribution, and local area network (LAN) service support. There are 219 LSPs on the Bloomington campus. If the salary and benefits for these LSPs averages $40,000 a year for one employee, the total cost for their expertise and efforts is $8,760,000 a year. The cost of their services per computer (per faculty and staff member) is approximately $1,991 per machine each year. UITS, in turn, spent $4,559 in 1998 to support each LSP (Peebles and Antolovic 1999), and that added $207 to the support costs of each computer.

Thus, support costs for faculty and staff computers are approximately twice the life-cycle costs of the hardware. These figures, which are good estimates, are close to the current ABC figure for the full costs of computers and software in the Bloomington campus student technology centers: hardware, $2,256 per machine each year (three-year replacement cycle) and software, $701 per machine each year.

The figures offered above provide reasonably reliable estimates of the full costs of supporting desktop computers. The most frightening element in these sums is that the cost of hardware and software could decrease to zero; yet, the majority of the costs would remain. These figures can be used for planning, but they can also be used for active management of cost and quality. The final example brings together all of the measures that constitute a case study of activity-based management.

An Example of Activity-Based Management: E-mail

In 1994, Indiana supported a bewildering array of e-mail systems. On the administrative side of the operation, users depended on a homegrown variant of SysM, known as EMMA, that ran on the mainframe. This system automatically delivered various notifications, such as the approval and execution of purchase orders. The system also offered an integrated calendar for its users, generally the administrative computing staff and university administration. The university's business school used an IBM mainframe and IBM mail system, PROFS, for internal communication. The business school believed that knowledge of this system was necessary for its students and for the school to achieve the goals of its instructional program. Most students and faculty used DEC Mail, which ran on a very large cluster of DEC VAX and DEC Alpha Servers. Some students and faculty used a UNIX-based system, PINE, which was written and maintained by the University of Washington and which had proved very reliable as a centralized mail service. Several departments and schools had adopted GroupWise, an integrated messaging and calendar application from Novell. Other departments had settled on various LAN mail packages, such as ccMail, Pegasus, and Eudora, and they would "pop" their mail from either departmental or central servers. There were a few remaining BitNet mail users, and even fewer users of UNIX mailers, such as Elm. In each case, the group that managed the operating system (VM, MVS, VMS, UNIX, MacOS, and DOS) managed the e-mail application. Hence, there were at least six different individuals or functions responsible for "mail." These software engineers resided in four different management units, and, almost to a person, these individuals suffered a high degree of operating system xenophobia. Consequently, neither the several mail systems nor the engineers who supported them talked to one another easily.

Although there was general satisfaction with DEC Mail, it clearly was not cost-effective. It ran on very expensive servers and came into direct conflict with users who depended on these machines for the power of their central processing units (CPUs). The physicists and computational chemists were stymied in their work by reams of e-mail moving through the CPU, across the data bus, and out onto the network. GroupWise, although a local solution, proved almost impossible to grow beyond a few hundred users and did not recover gracefully when it crashed. Other LAN mail offerings were very hard to support centrally, especially those that used nonstandard protocols. In general, the e-mail systems were not cost-effective; were generally written with proprietary rather than open standards; and, given the variety of systems deployed, placed an undue burden on the university's support center and the education program.

Electronic mail was completely reengineered during the 1994–95 academic year. Over the year, the mainframe systems, EMMA and PROFS, were eliminated. DEC Mail was phased out. GroupWise was not allowed to expand, at least not as a central service, beyond where it was at that time. PINE, which at that time supported both character-based "terminal" connections and the POP3 (Post Office Protocol 3), became the central mail service. It was deployed on several dedicated UNIX servers, and it has continued to serve the campus to the present day. In 1996, a few departments adopted Microsoft Outlook/Exchange as an experiment, and UITS offered it to faculty and staff for evaluation. All of the engineers responsible for the reduced set of e-mail systems were gathered into a single, integrated messaging team, and the quality and cost of all e-mail services, as well as listservs and newsgroups, became their responsibility.

Questions about this "central systems retooling project" (Stewart et al. 1998) that consolidated e-mail, among other things, were included in Indiana's user survey for 1996. To the question about overall satisfaction with the move to PINE mail, 94.4 percent of those who responded rated the move as "good" to "excellent," and the satisfaction score was 3.99 on a scale of 1 to 5. To a question about satisfaction with the process of communication and education of these changes, 94.1 percent rated it as "good" to "excellent," and the satisfaction score was 4.05.

Table 10.1 outlines the measures for the cost and volume of e-mail at the Bloomington campus over the last three years, that is, after reengineering. In 1996, there were 66,000 e-mail accounts on Bloomington central servers. As additional Indiana campuses established their own e-mail services (as noted above, Indiana has eight campuses, almost 100,000 students, and from these figures, perhaps 170,000 separate e-mail accounts), this number had shrunk to 46,000 accounts in 1998. The number of messages delivered each year decreased from 307 million in 1996 to 179 million in 1998. The cost of each message stayed more or less stable, at between $0.001 and $0.002 per message. The cost of maintaining an e-mail account dropped from a high of $9.80 an account in 1997 to $6.11 in 1998 (a reflection of the cost of depreciation of the servers). The real change over these three years was in the absolute size of each e-mail message. In 1996, 307 million messages contained 1.2 million megabytes (1.2 TByte) of material; in 1998, 179 million messages carried 391 million megabytes (391 TByte) of material, an almost 400-fold increase in three years. E-mail no longer was just a few lines of ASCII text. It had turned into a few lines of text and a few megabytes of attachments.

Today, PINE provides the e-mail service for more than 90 percent of the students and more than 40 percent of the faculty and staff at the IU Bloomington campus. Approximately 50 percent of the faculty and staff use Outlook/Exchange (this service has not been offered to students for reasons that will become apparent below). Approximately 9 percent of the faculty and staff use

	1996	1997	1998
Number of Mail Accounts	66,000	48,000	46,000
Number of Messages	307,000,000	270,000,000	179,000,000
MB Received	1,258,000	Not applicable	391,825,000
Cost/Message	$0.001	$0.002	$0.002
Cost/Account/Year	$8.96	$9.80	$6.11

Table 10.1 Volume and Cost for E-mail Services in Bloomington, 1996–98 Academic Years

	1996		1997		1998	
	Percentage Satisfied	Satisfaction Score	Percentage Satisfied	Satisfaction Score	Percentage Satisfied	Satisfaction Score
PINE	95.1%	4.1	90.5%	3.9	85.8%	3.7
UNIX Mail (Elm)	82.1%	3.5	82.2%	3.5	62.2%	3.0
Eudora	96.5%	4.2	87.8%	4.1	92.3%	4.1
GroupWise	89.0%	3.8	78.4%	3.8	76.9%	3.5
Exchange	96.3%	4.2	85.0%	3.8	92.5%	4.2

Table 10.2 User-Perceived Quality Measures for Five E-mail Systems Used in Bloomington, 1996–98 Academic Years

GroupWise; 9 percent use Eudora; and approximately 1 percent of the faculty and graduate students use some version of UNIX mail, generally Elm.

The change in the character and content of e-mail has had a direct effect on user satisfaction with the e-mail service offered by UITS. As shown in table 10.2, satisfaction with PINE, which does not handle attachments well (one must save the file on the server and then FTP [file transfer protocol] or fetch it to the workstation), has fallen from 95.1 percent satisfied in 1996 to 85.8 percent satisfied in 1998; the corresponding satisfaction score fell from 4.1 out of 5 to 3.7 over the same three years. Satisfaction with GroupWise has fallen each year, and it is a strong candidate for elimination as an application supported by UITS. UNIX mail has few satisfied customers, but for some reason, people choose to use it anyway. Only Eudora, a POP mail client, has devoted, satisfied users.

Given the decreasing satisfaction with PINE as an e-mail client, the messaging team began the search for its replacement. The goal was to offer a Web-based mail client that would handle attachments transparently. The primary requirement was that the client and the server use "open" standards: POP or IMAP (Internet Message Access Protocol) or, preferably, both. Secondary considerations included the ease with which client and server applications could be supported. A tertiary consideration, which became the rallying point for an all-out technology conflict among the messaging team and other parts of the telecommunication division of UITS, was support for MAPI (Messaging Application Programming Interface). MAPI is a Microsoft proprietary standard that allows the integration of most messaging functions, including e-mail, voice mail, fax, and calendar, to work through a single client such as Microsoft Outlook/Exchange. The strength of the hostilities and zeal of the various proponents did not quite reach the level of the First Crusade but did exceed the religious wars between believers in the two major networking protocols, Gigabit Ethernet and ATM.

One proposal, which at one point was offered as "take it or leave it," was to convert the entire messaging infrastructure to Microsoft Exchange Server, which offers IMAP and POP protocols in addition to MAPI. In this way, most mail clients, such as Netscape Messenger, could be supported, and support for the PINE client could be phased out smoothly. The implication, however, was that with the university-wide Microsoft site license negotiated in 1997, the majority of users would choose Outlook or Outlook Express as their clients. This solution would provide personal, network-aware calendars and would guarantee smooth integration with other Microsoft applications such as Word and Excel. There were three drawbacks to this proposal, although the proponents of Exchange presented these as features rather than shortcomings. First, Exchange servers can only handle about 2,000 users per node. Consequently, there would have to be approximately 25 servers plus a few spares, and these would have to have a common directory service. Second, the issue of "scaling" was unresolved. There were few Exchange environments with 50,000 active users that could be used as models. Moreover, if all of the university were to be included, there would be almost 170,000 users in this one messaging environment. In addition, there were very real questions of support and education in an environment where the university gains approximately 8,000 new users each year on the Bloomington campus alone.

Last, but by no means least, this option not only solved the problem of attachments but offered services, such as public and private calendars, integrated voice mail and fax, and other features that were not a high priority or that could not be offered as a service to the vast majority of the customers, the 35,000 students on the Bloomington campus.

The second option would be to continue to build a robust UNIX environment that supported both IMAP and POP protocols. There are several commercial solutions that handle up to 1 million accounts and 100,000 active users in a mature, "high availability" messaging environment. The other part of this option was to find and deploy Web access to this IMAP mail store or facilitate some use of IMAP-compliant desktop clients, such as Netscape Messenger or Outlook Express. The main emphasis was to offer Web access from a browser that would look and function something like the interface presented by the commercially successful "Hotmail." This choice would be the most efficient and effective way of dealing with the most egregious shortfall of PINE, which is its inability to easily handle attachments in today's point-and-click-centric world. The drawbacks to the desktop clients mentioned above are that, at least today, they rely on nonroaming users—users who have an established desktop computer (or set of computers) that they consistently use. In a university environment, where mobility is the rule rather than the exception, ubiquitous access is a nonnegotiable requirement. Such ubiquity can only be found with true Web-based solutions available through pervasive browsers (Netscape or Internet Explorer). In 1998, Web-based, centrally served mail readers that contained the core of features that Indiana sought were not readily available. But as 1999 drew to a close, several Web e-mail products were available on the market, with more being released each month. UITS tested two such Web clients and planned to release one or both for general use early in 2000.

The hardware life-cycle costs of the UNIX IMAP-Web server environment and the Exchange server environment were roughly the same. Both would provide the computing power and the disk storage to support the growth in message size and complexity. In either case, these costs were built into the ongoing budgets for messaging. Likewise, the costs for the clients had either been included as a part of various existing site licenses or were quite small on a per user basis and could be added easily to the life-cycle costs for messaging. In short, the cost of the hardware would have little effect on the cost of either an e-mail message or user account. The only absolute increase would be in the amount of disk and tape storage that would have to be added to contain the increasing size of each message (predicted, in aggregate, to be at least one petabyte by 2002). There were concerns about the fragility of the Exchange hardware infrastructure and the ease with which database corruption could be repaired, but these too were not insurmountable.

The deciding factor that led to selection of an IMAP-Web mail client for the vast majority of e-mail accounts was the cost of support. Reports on these costs were assembled from the number of calls the UITS support center in Bloomington received during the 1998–99 academic year that asked for help with Outlook/Exchange and PINE. A similar report was written by the UITS support center at the Indianapolis campus to serve as comparison and validation. (Note that all calls are logged by user and type of problem and tracked to resolution in both support centers). Table 10.3 outlines the results of these queries.

	1998–99				
	Total Number of Users	Number of Calls to Support Center	Call per User	Percentage of E-mail Calls to Support Center	Percentage of Total Calls to Support Center
PINE Bloomington	44,000	1,537	1 per 28.6	23.8%	2.4%
Outlook/Exchange Bloomington	4,500	1,773	1 per 2.5	27.4%	2.7%
PINE Indianapolis	45,000	1,943	1 per 22.7	22.7%	4.2%
Outlook/ Exchange Indianapolis	6,000	2,425	1 per 2.5	28.2%	5.3%

Table 10.3 Comparative Measures for E-mail Support Requests in Bloomington and Indianapolis, 1998–99 Academic Year

In both Bloomington and Indianapolis, users of Outlook/Exchange had 10 times more problems than those who used PINE. If Outlook/Exchange were extended to all 44,000 mail accounts on the Bloomington campus and if the cost of a call to the support center were $7.00 (actual ABC figure for 1998–99 was $6.94 a call), the support cost, which is part of the life-cycle cost, would be almost $125,000 a year. This amount is almost equal to the yearly depreciation cost of the hardware that would deliver the e-mail. Moreover, it certainly would not be the full support cost, because it does not include the use of the UITS knowledge base to answer questions about e-mail, nor does it include the cost of LSPs, who, as noted above, are the front line for IT consulting in departments, schools, and operating divisions on the Bloomington campus. Although the extra features of Outlook/Exchange are valuable to and used by half of the faculty and staff in their work, these features are not worth the support costs to offer Outlook/Exchange to the entire student body at the Bloomington campus. A robust IMAP-Web client for mail, however, does meet all of the students' needs and is a cost-effective solution to their requirements—ease of handling complex attachments (including MP3, MIDI, and JPEG) and music and image files.

Conclusion

Strassmann (1997) argues persuasively that computers destroy more value than they create. Landauer (1995) shows that the power of computers to destroy value lies in the software that is written for them. He offers compelling narrative that demonstrates that those who write software, with few exceptions, do not focus on what he calls UCD3: user-centered design, user-centered development, and user-centered deployment. In brief, software fails both of Juran's tests (1999) for quality (of anything): fitness for use and freedom from defect. Minasi (1999) would certainly support that conclusion. The December 6, 1999, issue of *Business Week* headlined a special report titled "Software Hell: Is There A Way Out?" The authors of this article conclude that it will take more than "good intentions" to lift ourselves from the pit of bloated, bug-ridden applications and opaque operating system software. One path out of the annoying software sewer is offered by "open source" operating systems (such as Linux) and application software (such as StarOffice) and the use of parallel, distributed development that characterizes the creation and continuous improvement of these systems (Raymond 1999).

Drucker (1999), among many others, is convinced that e-commerce and knowledge-based industries have transformative powers equal to the agricultural and industrial revolutions and the adoption of printing with movable type. Lucas (1999) has specified the conditions under which it makes good sense to invest in IT and the ways in which these investments should be evaluated. Some IT investments are required just to stay in business. Certainly, a university detached from the Internet would not be in a strong competitive position (unless it occupied a niche that stressed only the life of the mind and otherworldliness). IT can also have transformational power, as universities have discovered with distributed learning and business process renewal (Katz and associates 1999; Oblinger and Katz 1999; Bates 2000). If higher education is to realize the full value of investments in IT, it will have to contain the elements of IT that destroy value. At the moment, the best way to reduce the waste caused by the poor quality of applications is to create IT organizations that can respond quickly and decisively to the vision and goals of the institution and address the needs and requirements of the students, faculty, and staff proactively and rapidly. A strong support organization, with both distributed and centralized components, is the cornerstone of such an effort.

Drucker's epigraph (1990) that begins this paper is apposite. It is clear that UITS has followed his admonitions with quality, fact-based, customer-centered management and provisions of IT services. UITS creates applications development teams that comprise both functional and technical personnel to ensure that UCD3 considerations are built-in at the beginning of each project. The Balanced Scorecard and other frameworks, such as the Malcolm Baldrige National Quality Award criteria, give productive focus to the management of service as well as manufacturing enterprises. Unlike the world of for-profit businesses, university customers, in general, do not have an "exit strategy." There is no "elsewhere" they can take their custom. They are stuck with us. We, in turn, are stuck with hardware and software that, in many instances, are not designed with the user in mind. Consequently, it is imperative that IT organizations offer as many clearly defined, highly visible entry points to the organization for user support and education as can be designed and maintained. Maintenance and enhancement of these support organizations is every bit as much a part of IT life-cycle costs as are costs for the next server and those gigabit routers that will have to be put in the switch rooms and wiring closets. As Drucker closes the chapter from which the epigraph is taken, he writes: "There are no results inside an institution. There are only costs" (Drucker 1990, 120). The costs can be measured in ways that offer more effective management; only the customers can judge the results.

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John F. Moore and J. Thomas Head

11

Virginia Tech Faculty Development Institute

Virginia Polytechnic Institute and State University is a Research I land grant university with more than 25,000 students and 1,600 faculty. The Virginia Tech Faculty Development Institute (FDI) began in fall 1993 as part of the Instructional Development Initiative (IDI). The IDI has the following four component activities:

- The Faculty Development Institute
- Outfitting classrooms with computer projection and interactive videoconferencing equipment
- Creating computer labs to assure that students without a personal computer can complete assignments
- Supporting course development

The primary IDI goal is to improve the quality of instruction through the integration of information technology in teaching and learning. The goal of FDI is to help faculty learn how to incorporate technology into courses by providing intensive summer workshops designed to explore alternative instructional strategies.

Overall planning involved development of a project plan and budget for a pilot year of activities plus a four-year cycle of workshops, facilities development, and course enhancements. The planning effort began in September 1993 and was concentrated in a nine-month period leading to the pilot sessions. The pilot year planning involved key administrators in information systems and two associate provosts. Planning the pilot year also involved frequent involvement with faculty and department heads who would attend summer workshops.

Most issues considered during pilot year planning have since been successfully implemented.

- The university administration adopted recurring funding to provide a four-year cycle of FDI so that workshop costs and technology replacement for 25 percent of the faculty each year were reallocated to the IDI project. A second four-year cycle is now under way.
- Presentation classroom facilities and computer labs were likewise budgeted for recurring replacement on a periodic basis.
- Each summer, about 20 workshops are held and attended by 400 faculty for three or four days. Faculty acceptance of the FDI project was such that the anticipated 80 percent participation rate grew to 95 percent by the end of the first four-year cycle.
- The use of workshop planning groups worked well, building an early connection between participants and the workshop staff while helping to create ownership of the customized content.

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Planning Practice

The FDI was considered from the outset as a strategic initiative that would provide a competitive advantage for the university in the rapidly changing landscape of higher education. A recurring investment in the faculty of the university was considered essential for the long-term health of the institution. An overarching tenet during the FDI pilot planning was to do everything possible to ensure that the model could scale to encompass the entire university, in terms of funding, logistics, faculty interest, and administrative support. Coordinated with the workshops were the initial development of three computer labs and the outfitting of 12 classrooms for computer-based presentations. In a larger context, during this time the university was undergoing a series of budget reductions with the threat of faculty and staff layoffs and subsequent reorganization involving a strategic planning process.

A major part of the early planning was to ensure that the scope of the effort had a sound academic base and administrative sponsorship. The original idea for the FDI emanated from the vice president for information systems and the university provost. The budget for the project was authorized through a collaborative effort of these two offices. After a plan was formulated, it was submitted to the president, who provided the final approval. Directly involved in the pilot year planning were the vice president of information systems, the director of instructional services (a division of information systems), the director of educational technologies (a unit within instructional services), and two associate provosts. Many other information systems staff members, from educational technologies, the computing center, network services, and university libraries, were also integrally engaged in the planning and execution of the initiative. Weekly meetings were held with the project group, and biweekly meetings were held with managers from all participating information systems units for review of plans and troubleshooting. Responsibility for overall success of the project rested with the vice president for information systems.

Planning the workshops involved frequent involvement with faculty and department heads. We planned to customize each workshop to their forthcoming teaching needs, while also including a set of content necessary to enable a shift of computing resources from the mainframe to the desktop.

Software used to support the planning process included spreadsheets for budget planning and project management software for timeline development and progress tracking. These two technologies were extremely valuable as they aided what-if scenario building while serving to communicate a common vision and plan to all the project team. Demonstrations of software were frequently held to gather feedback during the planning process.

A recurring investment in the faculty of the university was considered essential for the long-term health of the institution.

The pilot phase also needed to be small enough to be manageable and assessable, with a variety of steps taken to control risks for both faculty participants and administrative sponsors. A number of issues were considered.

- Desktop computers needed to be available across the university. Each computer and its software needed replacement on a scheduled basis to maintain an adequate performance for faculty to work with modern software. These replacement costs needed to be treated as operating, not capital, expenses. Thus, the FDI workshops had to provide each participant with a modern workstation, software, and a network connection, and had to provide replacement of the technology and further training to all faculty on a recurring basis, such as a four-year cycle.
- Because the university's most important asset is the faculty, provision of a recurring opportunity for all faculty to participate in an intensive development program focused on teaching and technology was considered essential to the future of the university.
- In all workshops, each faculty member undertook a personal miniproject to provide practice in applying techniques learned, using relevant course content. We envisioned projects to be an important part of each workshop, with the general aim that each person might leave the workshop with something useable in a class. Projects were supposed to help make the instruction more relevant by

grounding the concepts within each faculty member's content area.

- We wanted faculty to feel comfortable and not threatened in the workshops. Lesson content was frequently checked for jargon and gaps in the step-by-step instruction, which lead to confusion. We hired graduate students from the instructional systems program to act as lab tutors within the workshops. They added a high-touch element to the workshop by helping faculty who needed further explanations and assistance in directing and synthesizing workshop content toward their personal projects.
- We tried to create and leverage conditions that would encourage faculty to integrate technology fully into their teaching rather than treat it simply as a supplement. For example, the FDI pilot year was linked to three academic areas already engaged in curriculum revision as part of a university-wide examination of the core curriculum. A number of faculty were simultaneously engaged in departmental curriculum revision, with the result that they would have immediate reliance on technology during the next semester as part of their teaching assignments. Math faculty used Mathematica as part of their calculus reform. English faculty incorporated Daedalus within classes to support online writing and dialogues. Humanities faculty used the provision of the Perseus archive of Greek history in several different courses.
- We were unsure whether faculty would want to spend a week of summer participating in a workshop. To encourage their participation throughout the pilot year, faculty received stipends as well as a desktop computer, even though we were concerned about how the long-term costs of stipends would affect scaling up the project.

A subagenda was to ameliorate the uneven per capita ownership of desktop computers across the colleges to enable more effective cross-disciplinary collaboration. The participation plan deliberately allocated a disproportionately higher number of workshop seats to certain colleges during the first two years of FDI (but fewer seats in the later years). Thus, departments in these colleges could get their faculties equipped more quickly, especially if they were involved in teaching large core courses. In effect, the FDI (especially at the outset) sought to boost computer access and instructional use across the university by focusing early participation on those departments that taught large numbers of students and that had curriculum revision already under way. In line with our mission to improve instruction, we encouraged each college to emphasize teaching excellence rather than computer literacy as one criterion for early participation. However, the departments, not information systems, always selected the participants.

After the summer pilot workshops, frequent formal and informal contact was maintained with the faculty involved to inform the planning of the larger IDI initiative. Observations in classrooms and labs were combined with periodic surveys of both students and faculty. The surveys assessed instructional changes and student reactions, while exploring the benefits, problems, and reflective analysis by faculty on the workshops and the larger initiative. Planners used this information to build support for moving beyond the pilot stage of the IDI.

In an early review of the pilot workshops, the provost estimated that 80 percent of the university's 1,500 faculty might voluntarily participate in a multiyear series of FDI workshops. A four-year plan for university-wide participation was created with leadership from the provost's office. For each year, an agreed-upon number of faculty participants was allocated for each college so that by the end of the fourth year at least 80 percent of the faculty in each college could choose to participate.

Execution

We were pleased that most issues considered during pilot year planning successfully came to fruition as the FDI began regular operation in 1994.

- A scalable model was created. The university administration provided funding for a recurring four-year program cycle so that workshop and technology replacement costs for 25 percent of the faculty each year were reallocated to the IDI project. A second four-year cycle is now under way, and an enhanced three-year cycle is planned for afterward.
- Presentation classroom facilities and computer labs were likewise budgeted for recurring replacement on a periodic basis.

- About 20 workshops are held each summer, and approximately 20 faculty attend each of these sessions for three or four days.
- Faculty acceptance of the FDI project was such that the anticipated 80 percent participation rate grew to 95 percent by the end of the first four-year cycle.
- Each college developed its own method of selecting faculty to participate each year. Competition was reportedly vigorous in the early years, with one college requiring faculty to describe plans to make course changes as a result of attending a workshop.
- Stipends were not provided after the pilot year because faculty indicated that the training and a desktop computer were sufficient incentives.
- The use of workshop planning groups worked well, building an early connection between participants and the workshop staff while helping to create ownership of the customized content.
- The use of graduate students as lab tutors continues to be a highly rated aspect of the workshops, providing participants with synthesis of ideas and troubleshooting as needed.
- We also are pleased with the project orientation of the workshops, as faculty reinforce their need to apply what they learn to a personally meaningful context.

The planning for the FDI has never ended as it continues to evolve in different ways in order to respond to expanding faculty needs and interests, new technology options, and evolving university priorities.

All workshops during 1994–96 were targeted at groups of faculty either from individual departments (e.g., Mathematics) or from several related disciplines (e.g., a life sciences workshop comprised of individuals from the biology, animal and poultry science, forestry, and horticulture departments). The grouping decision was deliberate in order to intensify the prospect of curricular change. Clearly, it let some departments make rapid and large-scale adoptions of new teaching strategies, aided by a common understanding of the technology built during the workshops. Another benefit, seen in both departmental and related disciplines groups, was that faculty could meet each other and observe different strategies and attitudes toward using technology in teaching. A third significant benefit of discipline-related workshops was how they helped build a widespread awareness and understanding of the goals of the IDI project across the university, especially in the first two years of the FDI. By having many workshops composed of faculty from different related departments, there were soon faculty across the university who were familiar with the intent of the FDI and could speak about it with their colleagues. A small number of FDI veterans came to act as evangelists across the university, helping create a climate more conducive to widespread discussion and adoption of new teaching alternatives.

Planning for the FDI continues to evolve to respond to expanding faculty needs, new technology, and university priorities.

Much of the content of the workshops was expected to change each year in response to evolving faculty needs and our evolving understanding of new teaching and technology options. The FDI planners assumed from the start that frequent changes in the "product" would be required to offer faculty the most value for their time investment. This proved true. Consequently, planning of changes and additions occurs continually. Planning of workshop content was done each spring with the help of small planning groups of faculty from each of the summer's 16 to 20 workshops. Meetings with each group were held several times to gain an understanding of the group's specific needs and to customize the topics to be covered so they better matched those needs. Content could be added or subtracted as needed, and guest presenters for special content were often hired to meet expressed needs. This content planning process required many hours of meetings before the actual workshops commenced. It seemed to increase significantly the quality and relevance of the workshop experiences as well as the buy-in of the groups as they came to view the workshop as theirs.

Assessment was an integral component of FDI from the earliest stages of development. This included overall assessment of the project as well as electronic hourly evaluations of the workshop sessions. These assessment activities provided the mechanism for continuous improvement of the program. Changes could be implemented on the fly when the evaluations demonstrated the need for modifications.

With the growing awareness by faculty and students of the World Wide Web during academic year 1994–95, the overall focus of the FDI workshops shifted toward using the Web in instruction. This resulted in less emphasis on authoring tools (e.g., Authorware) and presentation software (e.g., PowerPoint). Although not considered in 1993 when the FDI was conceived, the Web's instant appeal to many faculty helped steer the workshop agenda.

Frequent adjustments to content were needed as Web tools and teaching strategies became more powerful. The content planning process for the workshops came to center on finding ways to reconceptualize teaching within the asynchronous context provided by the Web and on specific issues, such as using discussion groups within a Web-enhanced course. A number of faculty who had experience in using the Web in their courses presented sessions during the FDI workshops, giving a credible voice in response to questions about issues such as student-faculty communication and development time requirements. An outgrowth of these early Web-oriented FDI sessions was the rise of the Cyberschool project, a collective of arts and sciences faculty and educational technologies professional staff who helped each other learn and apply asynchronous teaching strategies. Cyberschool faculty led their college to offer totally Web-based courses at a distance beginning in summer 1995. They were also instrumental in later bringing about a university-wide computer requirement for all entering students.

During academic year 1995–96, we began to see a change in the workshop planning groups. Faculty clearly started to use instructional technology at a faster rate than in previous years, perhaps because of the FDI activities, the recognition of instructional technology in the university's strategic plan, and the general emergence of a Web consciousness. Whatever the cause, the past practice of customized workshops built around a common core of content was not a relevant solution for a small but growing number of faculty.

With the faculty's divergence in needs, interests and experience levels, the technique of grouping faculty for workshops based on their departmental affiliation had also become increasingly problematic. After summer 1996 sessions, we decided to change the workshops to a content track basis. Faculty registered for a workshop track based on their interests and experience rather than their department affiliation. For summer 1997, three workshop tracks were offered, and faculty satisfaction levels climbed. Grouping based on interests and application became our standard practice. As interests continued to expand and mature, the summer 1999 FDI grew to nine tracks. The workshop planning process shifted to focus groups held for each track's forthcoming participants during the winter and spring. An ongoing management challenge is to balance the explosion of topics requested against the relative value and life-cycle costs while keeping in mind the FDI goal to enhance teaching and learning throughout the university.

Lessons Learned

The FDI has been well received across the university and remains an important strategic program. The planning process has enabled the creation and continual enhancement of a responsive and scaleable program. The process now in place is more streamlined but runs the risk of diminishing contact with the number of faculty originally encountered. To guard against that for academic year 1999–2000, we began planning meetings with each college three months earlier than in the past to facilitate improved communication and program planning. The purpose of these meetings was to hear from faculty about their needs; preview our workshop plans; get feedback; and gather faculty's suggestions, comments, and advice.

The workshops should be positioned within the context of curriculum development and change, rather than simply as "computer training."

A significant point to emphasize for planners is that the workshops should be positioned within the context of curriculum development and change, rather than simply as "computer training." This is one area that probably should have received even more emphasis as the FDI project grew. During the past several years, we have found the beginnings of interest in instructional design, particularly among faculty who have acquired considerable experience using technology in their teaching. Three workshops in this area have recently been offered, with enrollment doubling since beginning.

Our future plans include building a more in-depth treatment of workshop content as faculty needs and experience continue to grow. We are also examining the possibility of enhancing course development support within the context of the FDI by offering asynchronous workshops during the academic year. Doing so should provide an extended period of time for faculty to create course materials, get additional help from online FDI tutors, and experience firsthand—as a student—how an online course can work. Another change we anticipate is to shorten the four-year participation cycle to a three-year period so that faculty more frequently get opportunities to refresh their skills in workshops and to update their computers and software.

Martin Ringle

Planning Practice

REED COLLEGE

THE IT STAFFING PUZZLE

Martin Ringle is director of Computing & Information Services at Reed College and president of the NorthWest Academic Computing Consortium. He has a Ph.D. in philosophy from Binghamton University and has consulted on technology issues for more than 90 colleges, universities, and foundations. His writings include *Is Strategic Planning for Technology an Oxymoron?* (1998) and *Forecasting Financial Priorities for Technology* (1997).

The rate at which information technology changes has created unprecedented problems for every aspect of planning: equipment replacement, software upgrades, faculty and staff training, facilities renovation, and so forth. The element of technology support that is perhaps the least tractable to planning is staffing. Accurately identifying the skill sets and the number of IT staff members who will be needed two or three years down the road has become virtually impossible, given the uncertainties of technological innovation. Matters are made worse by the fact that higher education competes directly with the private sector for IT workers, a competition that higher education is losing badly. The lack of a stable and technically qualified IT workforce is gradually becoming the weakest link in the technology resource chain at the nation's colleges and universities.

Planning for IT staff support is further complicated by a bipolar phenomenon: new staff who have critically needed skills are difficult to attract and even more difficult to retain, while existing staff, whose technical skills are often outmoded, may be deeply entrenched in their positions. Traditional staffing models provide little or no relief from this dilemma.

Unless an institution is willing to apply enormous amounts of money to the IT staffing puzzle—and most have neither the resources nor the will to do so—the only effective way to deal with the problem is to pursue a strategy of "staffing agility." If future IT staffing needs are unpredictable, colleges and universities must position themselves to take advantage of worker mobility rather than cling to a traditional model of long-term employee commitment. Given the inevitability of high turnover in IT staffing, institutions must stop trying to prevent it and instead learn how to manage it.

Reed College—a private, liberal arts college of 1,300 undergraduates located in Portland, Oregon—has confronted the IT staffing puzzle by establishing an apprenticeship program. Before the incorporation of the program, Reed experienced periods when as many as one-third of its IT positions were simultaneously vacant, sometimes for months. Since the creation of the program, the average vacancy rate has dropped below 5 percent and positions are rarely open for more than a few weeks at a time. Technology support is comparatively stable, although there has been little overall change in the annual turnover rate.

Turnover Tamed

Reed's apprenticeship program is based on the assumption that a three-year turnover rate for new IT staff members is acceptable, if properly managed. Several other requirements are also critical:

- Apprentices must have the ability to become productive within six months.
- Experienced staff are available and willing to serve as mentors.
- Apprentices can commit to the full three years of the program.
- After 30 months, apprentices will provide sufficient notice of their intention to depart in order to permit the recruitment and initial training of their successors.

Reed has had a great deal of success recruiting talented liberal arts graduates and training them in-house. Progress is monitored very closely, and an apprentice who does not appear equal to the demands of a position is released after six months. Those who meet expectations, however, receive 10 percent salary increases at six, 12, and 24 months. After two years, an apprentice salary is roughly on par with the amount that would be paid to a candidate with a bachelor's degree in computer or information science and a year or more of related experience.

The apprenticeship program at Reed, now in its third year, has been applied to six positions in three departments. By all measures, the apprentices have performed superbly and have helped the college meet ever-rising and ever-changing technology and user demands. By the end of the program, we anticipate that apprentices will be equipped to pursue higher paying jobs elsewhere or to remain at Reed as part of the regular staff if they choose. In the latter case, they are expected to continue the practice of providing ample departure notification to allow the college to recruit new apprentices for their positions.

Weighing the Benefits and Risks

One of the greatest benefits of the apprenticeship program is that it enables Reed to define or redefine skill sets as circumstances demand, thereby promoting greater staffing agility. Recruitment by the private sector has become less of a problem, although it hasn't disappeared. Most encouraging, perhaps, is the fact that IT staffing levels are comparatively stable despite the fact that costs have been substantially contained.

On the other hand, the approach is not without its risks. As positions are filled with apprentices, the overall amount of technical expertise of the IT declines, at least at the outset. Trouble-shooting is more difficult, tasks are completed more slowly, mistakes occur more frequently. Experienced staff members, playing the role of mentor, have less time to perform their other duties. And the departure of an experienced member of the staff can have far more serious repercussions than would otherwise be the case.

For an apprenticeship program to be successful, therefore, members of the community, including faculty, staff, and senior officers, must understand these trade-offs. Users' expectation levels must be adjusted to the limitations as well as the long-term benefits of an apprenticeship program, or it will not succeed.

Despite these risks, a well-orchestrated apprenticeship program can help an institution manage IT staff turnover in a coherent, sustainable way. From a fiscal viewpoint, this strategy may provide critical relief for colleges and universities—especially smaller institutions—struggling to maintain a technology environment growing more complex each year.

R. Dan Walleri

Planning Practice

R. Dan Walleri received his Ph.D. in political science from the University of Hawaii in 1976. He has been the director of research and planning at Mt. Hood Community College in Gresham, Oregon, since 1986. He has authored or coauthored 40 articles and book chapters dealing primarily with student outcomes assessment.

EAST COUNTY
INFORMATION TECHNOLOGY CONSORTIUM

COMMUNITY-BASED PLANNING FOR TECHNOLOGY

The concept for the East County Information Technology Consortium (ECITC), near Portland, Oregon, grew out of a meeting of superintendents and board officers from the eight K–12 districts, Multnomah Education Service District, and Mt. Hood Community College in April 1998. One of the important missions of these institutions is to anticipate and assist with emerging educational issues in the community. The pace at which technology is changing and becoming increasingly essential is one such issue. Given the costs involved in keeping pace with technological change, meeting participants agreed that the organizations should try to conduct joint planning for current and future needs related to information technology.

The driving forces behind the ECITC are as follows:

1. Responding to the training and education needs for all segments of our communities
2. Responding to the education and training needs of business and industry
3. Enhancing information exchange, coordination of services, and articulation across educational segments
4. Positioning for public and private grant funds available only for collaborative efforts

Potential projects include an area technology center, distributed community learning centers, distance delivery of instruction via the Web and video, collaborative staff development programs, Web-based services and data sharing, and linkages to other educational segments and workforce development programs. Projects completed or in process include an inventory of current capacity, analysis of needs, identification of common points of interest and potential partners, creation of a mission statement and plan, development of a Web site (www.eastcounty.org), and pursuit of funding sources targeting consortium efforts and technology.

The ECITC is currently overseeing a Community Access Capital Grant from the Mt. Hood Cable Regulatory Commission to develop applications of the institutional network being implemented by AT&T. Partners include Corbett School District, Gresham/Barlow School District, Reynolds School District, LSI Logic Inc., and Fujitsu Microelectronics Inc. Mt. Hood Community College provides administrative support and coordination for the ECITC.

Throughout this process, the number of organizational and individual members of the ECITC was increased to cover business and industry; local government;

workforce development; and nonprofit, social service organizations. Currently, 40 organizations are involved with 70 individuals participating. Quarterly meetings of the ECITC have been occurring since June 1998.

Process

The Web site provides both a description of what has been accomplished and a time line for the work of the ECITC. The success of the planning process is based on the commitment of various organizational leaders to the benefits of collaboration. This commitment helped ensure the participation of the technology and program people needed to make the ECITC a reality. From an organizational perspective, outcomes include cost/resource sharing, efficiencies, and access to resources (grant funds) that otherwise would not be available to the individual entities. Grant programs such as the U.S. Department of Commerce's Technology Opportunities Program, AACC/Microsoft Working Connections, and the U.S. Department of Education's Community Technology Centers Program require consortium-based applications. From a community perspective, the ECITC offers a vehicle for expanding access to information technology resources, especially for low-income and disadvantaged populations.

Technology Impact

Expanding community access to information technology has been a major driver in the development of the ECITC. For example, the business partners need education and training services independent of time and place. They also need customized training programs that can be delivered to their business sites. Thus, the ECITC is pursuing the delivery of these services through the local cable franchise grant. The costs of developing and maintaining a community-based information technology infrastructure was a key factor in motivating various organizational leaders to initiate a collaborative planning process.

What Worked

The ECITC has reduced "turf" issues and the natural tendency of these organizations to compete among one another for limited public and private funds. Completion of specific projects of mutual benefit to the organizational partners, such as the Web site and cable grant, has fueled success. Next steps include formalizing the governing structure (bylaws) and reducing the dependence of the ECITC on the local community college for administrative support.

Lessons Learned

To be successful, collaborative planning involving multiple organizations must be based on mutual gain rather than just altruism. The process has allowed the college and local K–12 districts to look at more options for achieving programming goals, such as the shared cost/use of computer labs. The K–12 district computer labs are often unused in the evening and on weekends. The college can use these labs to provide courses for adult learners.

The ECITC should have addressed the issue of governance earlier in the process. Long-term success requires ongoing commitment from the members. Currently, ongoing operations are overly dependent on the college.

The ECITC experience has clearly demonstrated the opportunities available from community-based planning for technology. Time will tell if the benefits actually realized justify the effort and result in long-term sustainability. For higher education institutions, a lot can be gained from such an effort with minimal risk.

Part 4

Integrating the Vision: Physical and Digital Learning Environments

University planners who create specialized learning environments are confronted by many challenges because the physical plant must increasingly respond to the needs of the digital plant. Unfortunately, many of these planners plan too few of any one type of facility to formulate patterns, standards, or guidelines. As a result, they are often forced to reinvent the wheel—ad hoc problem solving for each project.

The chapters in Part 4 provide examples of the patterns, standards, and guidelines that aid in development of specialized digital plant facilities. This book's early chapters were general, its middle chapters more focused, and these chapters specific. The authors have useful, if not unique, perspectives that are well articulated in their chapters.

These chapters are both pointed and timely. (Or, looked at negatively, these details are not likely to be useful 10 years from now even though the principles might be.) Joel L. Hartman suggests that certain decisions regarding equipment purchases should be delayed as long as possible to allow for acquisition of the most up-to-date version. Given the long lead time in capital projects—four and five years from concept to completion—this makes good sense.

In contrast to the pace of change in today's projects, it is striking to see how planners were guided in the days when land grant institutions were being established. The 1876 *American Agriculturalist* provided the following text as guidance:

> Set a number of earnest men, capable of teaching agriculture, down upon a good farm, with a good large house and barns upon it, and the cooperation of a good farmer; put up a few temporary buildings, if need be, for lecture rooms now and perhaps for stables by and by; give the Faculty a little money to spend upon books, apparatus and fitting up; let them know that they shall have more as fast as they can show results; let all permanent improvements be made with a view to the future and leave the Faculty as unhampered with regard to matters of instruction and discipline as pos-

> sible, and success of the most gratifying character will be almost certain in any State of the Union. (Boorstin 1973, 485)

Hartman's University of Central Florida is growing rapidly and is developing so many different buildings that he and his colleagues have been forced to develop very systematic means for managing these developments. His chapter, "IT Considerations in Facilities Planning," describes UCF's criteria, processes, and design standards. UCF has a formal method to involve users in project design, but Hartman also notes that there is no substitute for active involvement of the specialists who manage construction of the buildings that house the digital plant. UCF's substantial amount of new construction leads to a rich set of lessons.

In chapter 13, "Planning for Classroom Technology," Margaret McDermott and David E. Hollowell describe how the University of Delaware was able to consolidate many smaller planning projects into larger comprehensive and coherent projects, prompted, in large part, by a multimillion dollar gift for an instructional building. This gift stimulated fundamental changes in planning processes, which led to definitions and programs that shaped instructional resources throughout their institution—particularly in classroom development.

Bruce M. Taggart provides a case study in chapter 14, "Developing and Supporting High-Technology Facilities," showing how Portland State University—an established urban institution—adapted to changing student and faculty needs. His description is "every person's" experience, but he shares it with the reader in sufficient detail and sensitivity that much can be learned from both the examples and the very comprehensive lists of tools in use at PSU. His list of equipment and costs provides a full set of examples to aid those planning to build specialized facilities.

Two planning practices are included in this section as examples. In "New Tools for Community College Facilities Planning," Patricia C. Williamson describes how the Houston Community College System enhanced its administrative and trustee decision making through the use of GIS and database technology. Her lessons learned are both rich and informative. Patricia Seller-Wolff and Mark Wells describe in "From Blueprints and Spreadsheets to the Web" how Rice University used CAD technology and, subsequently, Web and Internet technology to manage its substantial facilities inventory and physical facilities. This could be a "man bites dog" example as the physical plant is cataloged and managed using the digital plant.

These chapters describe how technologies are effectively integrated into physical planning projects and planning processes. The authors in Part 4 have focused upon the principles while providing enough detail to describe current projects. This part is, however, at the narrow end of the funnel and tightly focused on the specific changes occasioned by today's technologies. We can see that technology-specific examples are likely to be outdated in a few years. A reading of the higher education literature of the 1960s, for example, reveals no awareness of the changes envisioned by Moore's Law and describes computing as instructional tools for dialogues (such as multiple-choice tests) and as administrative tools for simulating, modeling, and analyzing higher education (see Pfeiffer 1968). The digital era was not affecting thinking about technology except in very narrow ways. Similarly, our description today is likely to be outmoded in a few years.

Our final chapters focus primarily on site-specific higher education, but technologies that support remote delivery (as envisioned in chapters 3 and 6) are likely to dominate higher education growth within the next few years. In the 1960s lifelong learning was a description that included a limited set of options. Descriptions of networks, for example, were primarily lists of collaborating institutions (Vermilye 1974). Communication technology, transmission of images and texts, and standardization of Web browsers are tools today that will create their own life cycles and uses.

Our authors' focus on principles should help the timeliness of these texts, but we recognize that a few years from now we will require new chapters about the applications of technology in higher education.

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Joel L. Hartman

12

IT Considerations in Facilities Planning

Joel L. Hartman joined the University of Central Florida in 1995 as vice provost for information technologies and resources. He has overall responsibility for the university's directions in computing, networking, library, telecommunications, and media resources. Before that, he held a variety of information technology management positions at Bradley University. Hartman, an active participant and presenter at industry conferences, earned his bachelor's and master's degrees in journalism and communications from the University of Illinois at Urbana-Champaign.

Outwardly, the design of buildings on college and university campuses has changed little over the years. Inwardly, however, advances in technology, and their adoption in the teaching and learning process, have brought about major changes in the often-invisible infrastructure supporting these buildings. Issues ranging from the type of wire to be used to the ergonomics of workstations must now be considered in planning for new construction or facilities upgrades.

For many institutions, it is a rare opportunity to construct a new building. At the University of Central Florida, it has become a regular occurrence. UCF, one of the 10 public universities in the State University System of Florida, is one of the fastest growing institutions in the country. Today's student population of nearly 32,000 is expected to grow to 48,000 by the year 2010. Consequently, the university's 1,400-acre campus is the scene of constant construction activity. At the time of this writing, more than 40 new construction projects totaling in excess of $260 million and nearly 200 renovation projects are in various stages of design or development, with approximately one major building coming on line each year. This has made facilities planning an ongoing process.

Type of Construction: New or Remodeling

Facilities projects tend to be of two general types: new construction or remodeling. While similar, the two types of projects can present quite different challenges from the perspective of information technology integration. Of the two, renovation of older structures tends to present the greatest array of challenges. The classic renovation problems include a lack of equipment closets, difficulty in running conduits, sparse power distribution, rooms with an excessive number of windows, or low ceiling heights, to name a few. In many parts of the country, HVAC capacity is an issue in renovation projects where air conditioning is nonexistent or capacities are not sufficient to carry the new heating load. This can be especially troublesome in cases where equipment is added to locations such as labs, offices, or equipment closets where insufficient air movement or cooling capacity may exist.

Remodeling projects may not involve an architect or general contractor, placing increased responsibilities on the occupants or IT staff to participate in planning. Major remodeling projects generally consist of the following stages:

- **Conceptual design.** Staff from the unit(s) that will use the newly remodeled space, along with university planners, develop the functional requirements for the space.
- **Design-development.** Users' functional requirements are translated into drawings and specifications. Through a series of working sessions, interaction between users and space planning professionals refine the drawings and spec-

ifications until all agree that the plan meets the functional requirements of the conceptual design.

- **Bid.** The design documents are advertised for bid.
- **Construction.**

The time line for this process varies according to the scope and complexity of the project. It is important that IT professionals are involved in the project at the earliest stage of conceptual planning and throughout the design-development phase to help interpret users' functional needs and ensure that the appropriate technology infrastructure is designed into the project.

The involvement of fewer construction professionals in the process can also mean that the occupants—who are seldom versed in the intricacies of facilities planning and design—play a more prominent role and must therefore be helped to understand and accommodate the special construction features needed to integrate technology into the project.

To avoid placing unreasonable responsibilities on the future occupants of the space being designed, institutions should update their planning guides and specifications to include standards for basic IT infrastructure, such as cabling, distribution electronics, and wiring closets.

UCF's Facilities Planning Web site (www.fp.ucf.edu/noframes.htm) contains some useful information, including both state (www.fp.ucf.edu/guides/contents_bor-guide.htm) and campus (www.fp.ucf.edu/guides/contents_cost-contaiment.htm) technology specifications. Given the increasing importance of IT resources in supporting the teaching, learning, and research processes, IT must be treated as a fundamental resource—both programmatically and financially—not as an add-on. Even with this recognition, IT planners are often brought into a project at a late stage of the design process, possibly increasing the difficulty of integrating technology into the design.

Design Considerations

The ultimate goal of each facilities project is that the resulting structure or modification meets the needs of its users—the future occupants—within the overall scope of the project. This means, of course, that the users must be involved from the outset in planning and must be capable of clearly articulating their expectations and needs. It is desirable to have IT professionals involved in the conceptual phase of the design to enable a dialogue in which users and IT planners mutually determine the functional requirements of the facility and appropriate technology requirements to respond to those needs. Involvement of IT planners at the conceptual design stage will help users understand the potential applications of technology and better enable them to encompass the appropriate IT infrastructure in their plans.

Each project should begin with a thorough consideration of overall design goals and objectives. These should include the functions and activities that will take place in the facility, with the outcome being a set of functional statements, such as "Faculty using this facility will be able to access information in computer-based and video formats for immediate classroom display." These statements will form the foundation for both facilities and technology designs.

IT must be treated as a fundamental resource, not as an add-on.

Buildings outlive the technologies with which they are initially outfitted because people, programs, and technology change. Consequently, a fundamental design consideration is flexibility. The facility's design should facilitate adaptation to the widest possible range of activities and technologies. Flexibility with respect to technology can be provided through inclusion of empty conduits for future use, power and telecommunications outlets in strategic locations, maintaining open paths for adding or rerouting cabling, and sufficient space for new or replacement equipment. These elements add a one-time cost to the project but reduce total life-cycle costs because it is nearly always less expensive to include them at the time of construction than on a piecemeal basis at a later date. A decision on how much future capacity and flexibility to design into a project is a value judgment that those individuals responsible for the overall success of the project must make.

The design of academic buildings is changing to accommodate new, more student-centered and active modes of teaching and learning. The traditional theater-style lecture configuration is now giving way to arrangements that support team-based, individualized, and experiential approaches that may have students working in groups; engaging in some type of activity; or using technology to obtain, process, or display information. For example, tack boards may be needed in place of the usual hard walls, and power and network outlets may be required at every seat. Round tables may provide better support for team activities than row seating. The primary consideration here is to provide a variety of environments that permit teaching and learning to occur in a multiplicity of ways and to allow the facility and its infrastructure to gracefully adapt to future changes.

Consider the traditional face-to-face classroom. As the class begins, the door closes. For the next 50 minutes or so, an instructor and his or her students will remain in a closed environment, and the only information accessible is that which they share. Technology makes possible the "information-transparent classroom." That is, through technology, information in voice, video, or data format can be easily summoned, permitting access to outside information resources, or people, virtually anywhere.

New classrooms at UCF are designed to provide access to an array of communications technologies, including the following:

- Multiple high-speed data network connections (both wired and wireless)
- Multichannel closed-circuit television
- Streaming video
- ISDN circuits for videoconferencing at speeds up to 384K
- Telephones for support calls or audio conferences

These technologies allow faculty, with minimal advance planning, to have access to people and information, from on campus or elsewhere, and make them part of the classroom experience. More will be said below about multimedia facilities for classroom and conference room use.

Equipping academic buildings with an array of modern technologies is a relatively new phenomenon. Many facilities program plans—and budgets—may fail to fully account for the cost of technology. This can result from a failure to involve technology professionals in initial project design or from simple oversight. Either way, planners can find themselves faced with the dilemma of having to choose between technology and space. And, all too often, the decision is made to build the space and find a way to equip it later. Whether designing to budget or budgeting to design, including technology requirements at the earliest conceptual stage of design will reduce surprises later in the planning process.

Teamwork in Planning and Design

Technology planning for facilities construction requires specialized knowledge, much of it gained from experience. IT personnel at campuses with little construction activity may not have had the opportunity to acquire this knowledge. In such cases, it is appropriate to engage outside consultants to work with campus IT and user area personnel to accomplish the design and development work.

UCF created an IT Facilities Planning Committee whose task is to serve as an IT planning resource to assist building occupants and university facilities developers. Members of the committee include representatives from the Computer Services and Telecommunications Office, the Office of Instructional Resources, and Facilities Planning. The committee meets monthly to review campus construction projects, and members participate in the design and development planning sessions for individual projects campuswide. The committee becomes involved in projects from the earliest conceptual stages. Specifications for basic IT infrastructure, such as conduits and wiring, have been made a part of the university's planning guidelines for all projects (see the URLs listed above). The role of the committee, or individual members with specialized expertise, varies according to the developmental stage of the particular project:

- **Conceptual stage.** Each project is assigned a planning committee consisting of the future occupants of the facility and representatives from Facilities Planning. Members of the IT committee meet regularly with the project committee to offer recommendations on the technology infrastructure and facilities that will be needed to fulfill the project's mission.
- **Design-development stage.** As the project's conceptual plan is turned into architectural drawings and construction documents, the IT committee

contributes by providing specific IT facility specifications, locations, and other information.

- **Construction stage.** Throughout the construction process, members of the IT committee inspect the construction site to ensure that the specified IT resources are being installed correctly.

The committee provides consulting services and its diverse accumulated expertise, which helps university facilities planners and future occupants interpret and expand upon the university's written design specifications.

When the project is completed, staff from the units listed above provide ongoing training, maintenance, and production support of the technology resources for the building's users. Members of the committee stay on top of current technology and construction trends and, because of the high level of construction activity, are always looking for ways to improve each successive project.

With regard to planning, the IT facilities committee plays a consulting and coordinating role, interacting with Facilities Planning, the project program committee, and the project's architect and engineers.

Planning

While IT planning for individual facilities projects is essential, of greater significance is campuswide facilities planning. Having a long-term campus IT facilities plan and accompanying standards (see the URL references to facilities planning specifications above) assures that equipment and basic infrastructure will be consistent and compatible from project to project. It also helps forecast long-term infrastructure needs, such as underground duct banks and fiber and copper cabling. When planning a project, it is important to consider future projects that may be sited nearby. In this manner, duct banks and fiber and copper infrastructure can be sized to accommodate future demand.

Interchanges between IT planners and users can have a significant influence on the project's program plan. Later in the project, such interchanges with the architect, university facilities planners, and finally the contractor and subcontractors provide a means of ensuring that the ideas developed during the early planning stages are included in the project's design and are properly constructed.

IT infrastructure requires space, environmental support, and project dollars. In this regard, there is a natural competition between technology needs and the other space and equipment needs of the project. An important, but sometimes troublesome, area is "value engineering." Virtually every project requires cost control at some stage of its development. IT planners should make an effort to participate actively in the value engineering phase of each project to be able to discuss and, if necessary, defend the technology infrastructure as features are "value-engineered" out of the project. Sometimes they are simply ignored or forgotten. Addressing such deficiencies in the later stages of a project nearly always increases costs and often requires unwanted trade-offs. Continual involvement of IT planners will help to maintain an ongoing dialogue regarding the cost and space benefits of providing proper technology resources.

Examples of IT space needs include wiring closets; conduits, risers, and cable trays; rooms for central IT equipment (e.g., servers, media controllers and equipment, support staff); passageways to access equipment; maintenance areas; and offices for support staff. IT spaces also require generous allotments of power and air conditioning. Demand for these resources can vary. For example, designs can include a single central wiring room to which all outlet connections are "homed"; distributed wiring closets (central entrance facility with intermediate stations on each floor); or the placement of distribution hubs in each room, reducing the needed number of wiring closets. Each design has advantages and disadvantages, with differing impact on the project's design and implications for future maintenance and support.

Just as facilities need access to campus water and electrical service, they also need access to the campus telephone, data, and video networks. These underground services must be factored into each project. In a rapidly growing campus such as UCF, build-out of core communications facilities is a continual challenge. Often, each project has funding to support only its own underground infrastructure requirements, even though a future major building may be planned nearby. This is like installing a dozen garden hoses when a fire hose would be more effective and efficient. Underground construction is very expensive; however the cost of conduits and fiber and copper cabling is only a fraction of the total cost. When possible, it is always desirable to provide empty conduits and extra fiber optic and copper cabling to anticipate future needs. There are no hard guidelines for the amount of spare capacity to provide each new building. One or two empty four-inch conduits and 50 percent spare fiber are suggested minimums. To protect underground cabling resources, duct banks can be encased in poured concrete.

Although it is not glamorous, few IT resources equal the campus cabling plant in significance. These strands of fiber, copper, and coaxial cable connect every employee and student to the institution's voice, data, and video communications services. In the debate over fiber versus copper, fiber is winning. The advantages of fiber optic cabling are many, including immunity to electrical interference and enormous signal-carrying capacity. However, it is generally not feasible to build an entire campus cabling infrastructure with fiber because many endpoint devices cannot directly interface with a fiber optic connection. Devices requiring end-to-end electrical continuity also have difficulty operating over fiber. It is therefore necessary to design for hybrid fiber-copper cabling plants, typically with a fiber backbone extending to all buildings, interfacing with copper to the desktop.

Buildings outlive the technologies with which they are initially outfitted.

Then comes the question of what types of fiber and copper cabling to install. Options include single-mode and multimode fiber and Category 3, Category 5, Category 6, or higher grades of copper cabling. In general, single-mode fiber can carry greater quantities of information over longer distances than multimode. Likewise, the higher the grade of copper cabling, the greater the information-carrying capacity will be. Category 3 cable is typically used for telephone installations. Category 5 and higher are used for high-speed data but can also be used for voice.

Wireless networking is emerging as a viable technology. Following the ratification of the IEEE 802.11 wireless standard in 1997, wireless products from all vendors adhering to the standard can interoperate. Competition in the wireless arena is leading to improved features and reduced costs. For the present, wireless is best adopted in addition to or as an overlay to wired networks. The bandwidth achievable from 802.11 wireless LANs (two megabit and 11 megabit versions are available) is only a fraction of that achievable through wired networks; however, the flexibility of wireless makes it well worth consideration. Faster wireless bandwidths are on the way; therefore choosing the specific wireless equipment to use for a project closer to the project's completion allows selection of the fastest technology available at the time.

Whatever kinds of cabling are selected, it is essential that the institution adopt a standardized wiring plan that specifies all aspects of cabling and cable terminations for both underground and in-building plant.

Technological change proceeds at an uneven pace, with the frequency of change greatest at the periphery. For example, the average life cycle of a desktop computer is three years, while core network components and major servers are replaced at less frequent intervals. It is therefore important that both the core technology chosen and the cabling infrastructure that extends its reach throughout the institution be capable of upgrade through enhancement rather than replacement.

Multimedia Systems

Nowhere has technology had a greater impact on facilities design than in classrooms and conference rooms, where integrated multimedia display systems have replaced the once-standard chalkboard and overhead projector. Technology can make classroom and meeting room walls "information transparent." Equipped with appropriate technologies, students and faculty can obtain whatever information is available and communicate with anyone they wish, no longer limiting the classroom experience or the information that can be shared to that which is contained within the four walls.

Key components of a multimedia display system are a networked computer, data-video projector, screen, video camera, media control system, and ancillary media devices.

The PC is used to demonstrate the operation of various software and as a source of images and sound. It also enables display of models and simulations that can be manipulated in real time. The network connection permits instant access to outside information and communication, opening a range of possibilities from the Web and electronic mail to streaming video and desktop videoconferencing. Such capabilities give faculty powerful new tools for stimulating learning and student involvement. Any type of PC can be used, and choices will have to be made between Windows-Macintosh and desktop-notebook alternatives.

Like PCs, data-video projectors continue to increase in performance and decrease in cost. One can purchase projectors capable of emitting 1,400 to 1,500 lumens today for the same price as the 400- to 600-lumen devices available only two years ago. Delaying the selection of projectors until near the project's completion will allow selection of the brightest models then available.

Projectors that support resolutions from CGA (640 x 480) through XGA (1024 x 768) are available from numerous manufacturers and deliver image intensities from 600 to more than 1,500 lumens. This means near-photographic quality images in normal room light. Three types of data-video projectors are now available: CRT, LCD (liquid crystal display), and the newer DLP (digital light processing). CRT designs use three projection guns—red, green, and blue. These converge at the screen to produce a bright, high-resolution image. The chief disadvantages of CRT designs are cost and maintenance. Generally used in very large rooms, such as auditoria, CRT designs can produce a very bright image, but the devices often require painstaking setup and frequent adjustment. LCD projectors use a small image plate, similar in design to the screen on a laptop computer, through which light is projected onto the screen. LCD designs continue to advance in brightness and resolution, while decreasing in cost. For these reasons, LCD projectors are replacing CRT-type units in all but the most demanding applications. Because light in an LCD projector must pass through the liquid crystal imaging device, some brightness is lost. DLP, a new technology developed by Texas Instruments, is beginning to find its way into the market. The core of DLP systems is the digital micromirror device (DMD), a semiconductor light switch controlling 480,000 tiny mirrors on a single microchip. The mirrors are digitally controlled and individually activated to create very high definition, high contrast images with high picture uniformity and full color saturation from the middle to all edges. Computer-controlled signals cause the DMD's square pixels to switch on and off more than 1,000 times a second. The distance between pixels is approximately 1/100 the thickness of a human hair, reducing observable lines between pixels.

There are many choices to make when selecting a projection screen: manual or electric, type of screen surface, and standard or tab-tensioned design. The optimum choice is an electrically operated tab-tensioned screen with a video surface. "Tab-tensioned" refers to a screen design that uses wires and tabs on each side of the screen to tension the surface so that it is free from wrinkles that could distort the projected image. For optimum visibility, the top of the visible image area should be at a height equal to one-fifth of the distance from the screen to the rearmost row of seats. For example, if the last row of seats is 50 feet from the screen, the top of the screen should be 10 feet off the floor. The design problem induced by this simple formula is that the larger the room, the greater the required ceiling height. Most standard architectural designs do not provide for a 10-foot clear distance between the ceiling grid and the floor and must therefore be modified to accommodate projection. A distance factor is associated with the bottom of the projection screen as well. So that the entire image can be seen over the heads of those seated in the front rows, the bottom of the visible image area should be no less than 4 feet off the floor.

In addition to a computer and projection system, multimedia classrooms require an array of media devices. Obvious choices include a VCR or DVD player, laser disc player, and overhead camera (either a ceiling mounted or desktop "Elmo" unit). The overhead camera allows presenters to show written and printed material or three-dimensional objects. Media devices can be installed in each room or housed centrally and accessed through a central media control system. Each design—centralized or distributed—has cost and support trade-offs that should be carefully evaluated.

However, despite the ability to electronically display written material, many faculty or other presenters will still want a wall-mounted writing surface. Chalk dust is the enemy of media equipment. Consequently, media-equipped classrooms and conference rooms have migrated to the use of whiteboards and markers. Many whiteboards have suffered the indignity of being permanently stained by the inadvertent use of permanent markers. Newer designs have resolved this problem by using enamel surfaces that can be written upon with any type of marker. Hybrid marker-display devices, such as the Ibid marker board, deliver a standard whiteboard surface but with a PC interface that allows capture or display of the written material. One point to bear in mind is that by using an overhead camera to display writing to the class, the faculty member always faces the students, whereas with a marker board the faculty member looks away from the students while writing.

All multimedia classrooms and conference rooms will require an audio system with speakers facing the audience. The use of CD-ROM and DVD audio sources requires high fidelity, stereo sound reproduction. Voice amplification will not generally be required for rooms seating less than 100.

Taken collectively, this array of devices could present a formidable challenge to faculty attempting to integrate multimedia into their classroom presentations. Only a few years ago, it was necessary to use an individual remote control device for each piece of equipment. Today, all room systems can be controlled through an integrated media control system. Media control systems consist of central device controllers, which can be located in the classroom or in a central equipment room and operated through one or more user interface devices. Examples include touch screen panels and wireless hand-held controllers that use infrared or RF communication. RF is generally more flexible, because infrared controllers must be pointed toward the device they are activating.

Two major suppliers of integrated control systems are Crestron Electronics Inc. (www.crestron.com) and Panja, Inc. (www.panja.com). Both companies are migrating their controllers into the Internet arena by making controller devices that are network nodes with their own IP numbers and by using Web interfaces for control. There are many advantages to the networked approach, including centralized system management, monitoring, and software updating. Media control systems can operate not only the audiovisual equipment, but also room lights, sound levels, projection screens, and window shades, giving the presenter total room control.

Control of lighting in multimedia classrooms and conference rooms requires a media-centric approach. The goal is proper illumination levels, coupled with total light control. Windows represent a source of illumination that is difficult to control, and opaque draperies or shades are expensive to install and maintain. Windows also provide students with a source of distraction. Consequently, many classrooms are now being designed without windows. Student desktops must be properly illuminated for note taking and reading; however, light spillage onto the projection screen can seriously reduce readability.

Preferences for PC rather than Macintosh platforms make the choice of a computer into something of a religious decision.

Classroom lighting designs typically include fluorescent or incandescent fixtures. Fluorescent fixtures provide even illumination, low heat load, and cost-effective operation. However, their diffuse illumination pattern makes it difficult to prevent spillage onto the projection screen. When fluorescent instruments are used, their controls should be zoned so that individual rows or groups of rows can be turned off individually. Switched rows should be parallel to the projection wall, not perpendicular to it, so that illumination toward the front of the room can be diminished until the required effect is achieved. Incandescent downlights can be used, in combination with fluorescents, to provide residual note-taking illumination, permitting all or most fluorescent instruments to be switched off for presentations. Another effective design is to use track lights or similar instruments to provide a wall wash. Track lights can also be used to illuminate the presenter. Hanging pendant lighting instruments are becoming increasingly popular because they provide a pleasing effect by using both direct and reflected illumination. When using pendant lighting instruments, light control challenges similar to fluorescents will be encountered. In addition, the hanging fixtures must be placed so as to not block the projected image.

Individual fixtures can be controlled by switching, dimming, or both. Dimming systems add cost, and it is often possible to achieve the desired effect through switching alone. Vendors such as Lutron Electronics Company have recently introduced new ballast designs that permit effective dimming of fluorescent fixtures from full brightness to nearly total darkness. Connecting room lights to the multimedia controller through a low voltage interface will give presenters full control of both media and room illumination, with the bonus of greatly increased convenience. Several room light settings can be programmed into the controller to accommodate all planned activities. A single controller interface can eliminate the need for many individual light switches. One factor that must be taken into account when controlling room lights through the media controller is entry and exit lighting. It must be possible to enter or exit the room without having to operate the controller. One way to achieve this is to control one or two instruments in the rear of the room through a motion detector. When someone enters the room, the lights automatically come on, providing sufficient illumination to navigate.

Packaging all of this equipment into a convenient and easy-to-use design is critical. UCF has continually refined the design of a teaching console, which securely houses all of the necessary equipment but provides presenters with ready access to the equipment to operate it and to the technicians to install and maintain it. For additional information on UCF's multimedia classroom designs, see www.oir.ucf.edu/facilities/multi.html.

Although the console houses a PC and associated peripherals, many faculty wish to use a notebook computer. Therefore, all of UCF's multimedia consoles are equipped with an external plate providing power VGA and audio connectors so that any notebook computer can be used with the projection system. As a consequence of the above designs, three network connections are provided to each console: one for the internal PC, one for the media control system, and one for the external notebook.

Strong individual preferences for PC rather than Macintosh platforms make the choice of a computer into something of a religious decision. UCF has tried placing one of each in the console with limited success and, obviously, increased costs. The current solution is to place a high quality PC in the console and equip it with software that can read Macintosh disks (the current PC-to-Mac user ratio at UCF is approximately 8 to 1). Presenters who wish to use standard word processing, spreadsheet, or presentation software can do so. UCF has acquired a small number of Macintosh notebook computers and is lending them to Mac-centric faculty who wish to use the multimedia rooms. Many faculty prefer to use their own notebooks. Both solutions can be accommodated through use of the interface connector panel. Options to switch between the built-in and external computers are included on the touch-panel room controls. Faculty like the flexibility this arrangement provides, and the plan is to continue equipping rooms for use with built-in, loaned, and faculty-owned computers.

Multimedia classrooms and conference rooms can be readily adapted for distance learning or videoconferencing through the addition of cameras, a CODEC, and additional video monitors. At UCF, all of the interactive TV (ITV) classrooms are based on a multimedia foundation. This provides the ITV classes with a full array of presentation resources and allows the rooms to be used for regular classes when not needed for ITV use. Conference rooms can be equipped with a videoconferencing roll-about or an inexpensive desktop unit. ITV or videoconferencing equipment will require either a dedicated connection or ISDN telephone lines to link up with other sites.

Costs for a standard multimedia classroom in new construction run from $30,000 to $35,000. This breaks down as follows:

- 20 percent data-video projector
- 20 percent high quality overhead camera
- 20 percent media control system
- 20 percent media equipment
- 10 percent custom furniture
- 10 percent installation and programming

Renovating an existing room for multimedia will involve additional costs for lighting, window, power, and cabling modifications.

Ongoing Support and Maintenance

Having advanced technology and multimedia facilities is wonderful, but the true goal is for these facilities to be used effectively. This means that the faculty and staff who use them must be provided with ongoing training and support. This responsibility should be assigned to one or more campus units, such as the media center or teaching and learning center, and an ongoing program of faculty development and facilities support should be established. Training is no less important for the IT professionals who will support the facility.

Training can be provided by on-campus entities or by vendors, systems integrators, or businesses specializing in training. Likewise, maintenance can also be outsourced. Many institutions resist investing in proper training and maintenance, thereby limiting the potential benefits that could have been attained.

Once established, multimedia-equipped classrooms and conference rooms tend to become heavily scheduled. Time in these facilities should be set aside for preventive maintenance and training, if possible during off hours when the room is not in use.

Conclusion

The design, installation, and support of IT infrastructure are an important part of campus facilities planning. This calls for an integrated approach in which campus IT units, the institution's facilities planning department, and outside experts, including architects, engineers, contractors, and vendors, must collectively contribute to the project's success.

As with any major facilities project, there is only one chance to get it right. Change orders during construction or retrofits afterward are very costly in terms of both dollars and time. Planning for IT must therefore begin at the earliest stages of a project and continue throughout development and construction. After the facility has become operational, the emphasis will shift to ongoing support and maintenance.

Margaret McDermott and David E. Hollowell

13 Planning for Classroom Technology

Since 1988, Margaret McDermott has been involved in campus facilities planning at the University of Delaware, where she has had responsibility for the programming and planning of seven new major facilities. She has served in several volunteer capacities for SCUP, APPA, and SMPS. In addition to her duties at Delaware, she is currently facilitating the planning and development of a long-range plan for the buildings under the auspices of the Architect of the Capitol in Washington, D.C.

David E. Hollowell is executive vice president of the University of Delaware, where he has served as the chief administrative officer since 1988. He has been instrumental in efforts to reengineer and improve services, in integrating technology, and in initiating a major campus construction and renewal program. He is a past president of SCUP and has been a frequent presenter at professional meetings and workshops.

Over the past 12 years, the University of Delaware has reshaped its academic and student life through a series of new administrative initiatives. These initiatives have proved to be successful, in large part, because of the institution's willingness to abandon its traditional planning models and adopt more flexible and expansive methodologies. Past efforts revealed themselves to be inadequate in responding to the pressures of changing technologies, diminishing resources, and expanding programs, all of which required an integrated and comprehensive planning approach.

Historically, Delaware accomplished its planning through a series of discrete activities that often failed to link parallel efforts or address broader institutional goals. This generated a good deal of criticism by faculty and staff, who contended that planning outcomes frequently were narrow, riddled with redundancies, or at cross-purposes with competing interests. Although many of the criticisms were valid, these planning practices continued until it became apparent that they would be ineffective in supporting a series of new administrative initiatives that appeared beyond the reach of available resources. Concern arose as to how the university could accomplish these new initiatives without derailing a number of ongoing activities

The major components of these new initiatives included an ambitious capital building program and plans to seamlessly deliver technology across the campus, both of which supported Delaware's commitment to teaching and learning. The building program alone involved the renovation and construction of more than three-dozen major facilities, while the technology efforts encompassed all faculty, student, and administrative spaces. The scope of these projects and the need to deliver them swiftly and with limited resources heightened Delaware's awareness that the discrete nature of its former planning practices would need to be replaced with a broader-based process.

In response, the university elected to embrace a new planning model that differed significantly in both scope and intent from prior planning processes. Delaware's new approach focused on achieving more with less by combining divergent but compatible goals within a single project. This brought about a fundamental shift in planning behaviors among campus constituencies as diverse groups of stakeholders were brought together to collaborate on new ways to meet their collective needs. The success of this planning framework relied on forward-thinking leadership, cooperation, and synergistic planning strategies. How Delaware has approached instructional technology provides a good example of a successful planning project.

Supporting Innovation Through Technology

The goal of Delaware's technology plan is to improve the teaching and learning environment for students and faculty. Several university departments, including Media Services, Information Technologies, the Center for Teaching Effectiveness, and the Morris Library, have worked with faculty to develop, implement, and enhance

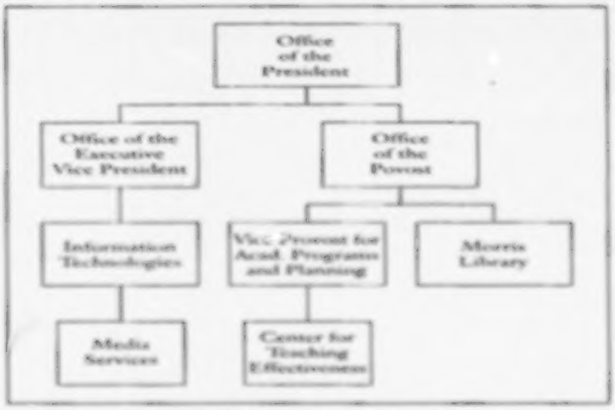
Office of the President
Office of the Executive Vice President
Office of the Provost
Information Technologies
Vice Provost for Acad. Programs and Planning
Morris Library
Media Services
Center for Teaching Effectiveness

Figure 13.1 Departmental Reporting Relationships

the university's instructional technology program. Figure 13.1 identifies the major groups involved in Delaware's technology plan and their reporting relationships. The technology plan is guided by the following principles:

- Establish levels of room technology, from simple to sophisticated, to meet a range of needs and to facilitate scheduling.
- Standardize technology.
- Create user-friendly spaces that are easily adaptable to instructors' needs and are designed to facilitate maintenance.
- Integrate and support a variety of teaching technologies in new and existing classrooms while promoting use and experimentation with these technologies.
- Encourage faculty self-sufficiency by providing skill-development programs.
- Link the technology improvement plan to classroom renovation and budget-planning cycles.

The above principles are most clearly demonstrated in the case study of Gore Hall, which subsequently has come to serve as the planning model for classroom design at Delaware. This 65,000-square-foot building was constructed in 1998 as the last freestanding building on the university's historic North Mall. Its prominent location, significant Georgian architecture, and designation as a general-purpose classroom building speak directly to Delaware's commitment to teaching, learning, and technology.

The decision to build Gore Hall resulted from a gift bestowed on the university in 1996 by the Gore family to support undergraduate education. This unexpected gift paved the way for the university to accelerate one of its long-range goals of constructing a classroom building on North Mall. The administration identified the need for Gore Hall to support the widest possible range of faculty pedagogies and technical requirements as a way of ensuring maximum use of the facility's 25 new classrooms, which represented an increase of 20 percent to the campus's general-purpose classroom inventory. The registrar saw Gore Hall as an opportunity to alleviate room schedule conflicts by increasing the overall inventory. The provost and faculty saw the facility as a vehicle for expanding the array of classroom types and sizes to support a wider range of teaching methodologies. Media Services, on the other hand, looked to Gore Hall to further its plan to advance classroom technology, while some faculty argued that the facility should serve as a technology showcase. However, the administration's goal was not to build a monument to technology but rather to have a building where every classroom would have the latest in instructional technology best suited to the size and type of room and compatible with the kinds of technology being deployed elsewhere on campus.

In order for these varied individual goals and perspectives to be successfully incorporated into the project, the university administration appointed a building advisory committee composed of faculty and staff to assist with the planning of Gore Hall. The committee members were selected for their abiding commitment to teaching excellence or expertise in areas related to technology, classroom scheduling, or facilities programming. Most of the faculty had experience with using classroom technology, but care was taken to avoid those few faculty members who were more taken with the technology than its effective use as a teaching and learning tool. The committee, led by the registrar and appointed by the provost and executive vice president, was charged with identifying room criteria responsible for fostering and promoting superior teaching and learning.

Representatives from several faculties, the Center for Teaching Effectiveness, Media Services, and the Scheduling and Facilities Planning and Construction unit set out to define, from their individual and collective perspectives, the room criteria that would ultimately serve to guide the building's interior architecture. They approached their charge by analyzing existing classroom space and then discussing and debating the merits of various room attributes and technologies as a means of developing meaningful room criteria. Despite the committee's varied academic and professional backgrounds, members ultimately identified the following areas as critical targets of concern when programming and designing instructional environments:

- Classroom array
- Student proximity
- Levels of classroom technology
- Technology support
- Room environment

Underlying these concerns are issues of room geometry, size, technology, lighting, furniture configurations, acoustical performance, and HVAC specifications.

Classroom array and student proximity. The committee determined that the ability to maintain good eye contact with the students during a lecture was of prime importance. The ability to see students at close range vastly improves the instructor's ability to actively engage students or determine if students are disengaging from the subject at hand. With this in mind, the committee considered a variety of classroom configurations before making its final recommendations to the architect and design team.

The case-study classroom, with its U-shaped tiered seating arrangement, was identified as an ideal instructional space for promoting student involvement. The room's seating configuration encourages eye contact and fosters interaction among and between the instructor and students. At Delaware, this room type was primarily housed in the College of Business and Economics, but the committee emphatically requested that several rooms of this type be included in Gore Hall. An earlier planning effort involving case-study rooms concluded rooms begin to lose effectiveness when they exceed four tiers and/or 80 seats. The committee agreed with this finding.

Although the case-study classroom may have been a preferred room type, the committee felt it important to look beyond traditional teaching conventions to provide for a diversity of teaching formats as a way to better meet the needs of Delaware's faculty and students. This led the committee to consider the inclusion of a problem-based learning (PBL) classroom as an alternative to lecture-style classrooms. PBL and its teaching methods rely on the interaction of small student groups to solve problems. Student clusters work independently to formulate solutions by utilizing paper and electronic resources, as well as their own knowledge base, to solve the problem at hand. Delaware had designed such a classroom four years earlier in response to initial interest among faculty. Over time, increasing numbers of faculty, and in particular science faculty, began to use the PBL classroom, which led the committee to conclude that such a room would be a valuable addition to Gore Hall's classroom inventory.

The ability to maintain good eye contact with the student during a lecture was of prime importance.

The remaining rooms in Gore Hall were designated to be traditional flat-floor lecture-style rooms. A good deal of discussion ensued among faculty committee members as they analyzed how to achieve proximity to the student. Ultimately, they developed a seating plan with a depth of five rows as the preferred scheme while recognizing that as the seating capacity increased, the room's geometry would shift to become wider rather than deeper to maintain the critical distance between instructor and student. The possibility that some rooms would be quite wide was not seen as a detriment, as instructors routinely move about a room when lecturing or utilizing teaching devices such as blackboards, overhead projectors, or other teaching technologies. This seating arrangement proved to be popular among faculty and has been adopted in classroom renovation whenever feasible.

Levels of Classroom Technology. The committee saw teaching technologies as essential and integral to Gore Hall and set out, under the guidance of Media Services, to define appropriate levels of classroom technology for the new facility. Technology-intense classrooms such as Delaware's instructional television (ITV) classrooms, ITV demonstration kitchen, and two-way video/audio classrooms have been part of the university's classroom inventory but are reserved for a narrow band of special uses. However, the technology of the university's general-purpose classrooms is what has contributed significantly to Delaware's reputation for improving learning through technology.

The availability of instructional technology in the general-purpose classroom inventory has increased steadily since the early 1990s, when Media Services first implemented a multiyear program to improve classroom technology. The program utilizes three levels of room technology, ranging from sophisticated to simple (levels I–III), as a means of providing consistent and robust levels of classroom technology. Figure 13.2 outlines the distribution of technology at Delaware.

Technology Level	Registrar Rooms	Room Type	Seating Capacity
I	15	Auditorium	80+
II	78	Case-study classroom	70+
		Large classroom	50+
		PBL classroom	30+
		Small seminar room	20+
III	65	Small classroom	20+

Figure 13.2 University of Delaware's Distribution of Technology

Each level is linked to a specific room type and size, affording the scheduling office the opportunity to align faculty needs with room capabilities. Initially, larger classrooms received more complex levels of technology and smaller rooms less technology for the express purpose of benefiting the greatest number of students at a single location. This approach continued until the programming of Gore Hall, when room occupancy patterns and preferences were carefully evaluated in conjunction with the project. Based on demand, the scheduling office's initial room-use recommendation was for several 100-plus-seat classrooms. However, closer analysis revealed that smaller classes were utilizing larger rooms to avail themselves of the more sophisticated technologies. The committee requested that smaller rooms be equipped with more sophisticated technology as a way of providing faculty with a preferred room size that ensured student proximity and increased the number of classrooms that could be built in Gore Hall.

The committee's request prompted Media Services to realign its technology deployment program to meet this formerly unrecognized need. Media Services also considered other ways to further improve its program to better meet the increasing demands of faculty. It focused on finding new ways to enhance the program's current technology levels without negatively impacting Gore Hall's established technology budget. A cost and performance comparison between current components and upgraded equipment indicated upgrading would have minimal impact on the budget due to the decreasing cost of technology. Media Services incorporated these changes into the design of Gore Hall after adopting them as program standards. It recognized, however, that these standards will continue to change as technologies and faculty skills evolve. Figure 13.3 identifies the program's technology components, levels, and associated room set-up costs.

Despite the increasing availability of classroom technologies, faculty proved to be uneven in how and when they elected to integrate technology into instructional preparation and delivery. The university addressed this issue of faculty readiness by providing resources and faculty-oriented programs to encourage the utilization of classroom technologies. Among the long-standing resources available to faculty are specialized services offered by User Services and Media Services. User Services provides skill-based workshops, customized hardware and software development, and one-on-one advising (www.udel.edu/learn/technology/), while Media Services provides training programs for technology equipment and on-site technical assistance.

Additionally, faculty continue to benefit from both the faculty desktop refreshment program, which is committed to replacing faculty desktop computing equipment at least every four years, and the formation of PRESENT (www.udel.edu/present/), a process-ori-

Room Technology	Level I	Level II	Level III
Custom-built lectern	X	O	
Lectern-mounted touch screen control	X	O	
Wall-mount/portable touch screen control		O	
High-brightness video/XGA data projector	X	O	
Medium-brightness video/SVGA/XGA data projector		X	
RF wireless remote for VCR, slides	X	O	
IR wireless remote for VCR, projector/monitor		O	X
CD quality sound system	X	O	
Wireless lapel and hand microphones	X	O	
Permanent assistive listening system	X	O	
Capability for assistive listening system	NA	O	
Closed caption decoder	X	O	X
Laser videodisc player	X	O	
DVD player	O	O	
16 mm film projector	O	O	
35 mm film projector	X	O	
Audio CD player	X	O	
Audiotape/player recorder	X	O	
Computer connection panel	X	X	
VHS videotape player	X	X	X
CCTV connection	X	X	X
Ethernet connection	X	X	X
32" video monitor		O	X
72" video monitor		O	X
Overhead projector	X	X	X
Current average cost per room	**$35–40K**	**$10–40K**	**$2K**

Key: X = always; O = optional

Figure 13.3 Room Technology for Different Classroom Levels

ented technology laboratory designed to assist faculty in the development and customization of technology-driven instructional programs. PRESENT promotes technical self-sufficiency among faculty by helping them select and develop technology applications for their coursework preparation and delivery. Both of these programs are augmented by the semiannual Faculty Institute for Teaching, Learning, and Technology, sponsored by Information Technologies/User Services, Media Services, the library, the Instructional Technology Center, and the Center for Teaching Effectiveness. The institute offers a comprehensive week-long series of workshops designed to train and familiarize faculty in the use of computer technologies.

The ability for faculty to access university resources and faculty-focused programs has proven to be a critical factor in accelerating the early adoption of classroom technology. As skill sets and experience have increased, faculty have become more aware that factors beyond their immediate control can adversely affect a presentation's outcome. The building advisory committee stressed the importance for faculty to feel confident in utilizing the new facility and its technologies.

Technology support. At Delaware, technology-enhanced presentations are now routinely developed by faculty members at their desktops and transported to the classroom over the university's campus network or carried via the faculty member's laptop computer. Although faculty acquire a sense of technological mastery as they develop instructional materials, they often feel less confident about their ability to utilize a particular room's technology for its delivery. This issue has been addressed in two ways. First, the university has standardized the kinds of equipment and technology used to control the equipment so that one room looks very much like the next in terms of the operation of the technology. Second, the Gore Hall committee recommended the inclusion of media prep rooms for faculty to preview their prepared materials prior to scheduled lectures. As a consequence, Gore Hall offers two such rooms equipped with an array of technological resources, including data ports with Internet connections and overhead and slide projection capability. The rooms are frequently used and, as a result, faculty have requested that similar rooms be incorporated into classroom buildings across the campus.

Faculty focus on room geometry, technology, and the overall quality of the teaching environment as most valuable.

Committee members agreed that the ability to preview materials significantly contributed to enhancing a presenter's confidence. However, the prospect of equipment failure would always be of concern to faculty. Media Services adopted an approach of responding to on-site failures by instituting a repair-by-replacement program in which malfunctioning equipment is replaced in-kind on-site. The program relies on an equipment inventory of standard devices that are familiar to faculty and that can be expeditiously changed with minimal class interruption.

This program is remarkably successful, and faculty now expect equipment failures to be resolved quickly with minimal interruption. Media Services recognized this and elected to provide a new technical hub in Gore Hall to serve the facility's 25 technology-enhanced classrooms. Initially, faculty saw the hub as an especially valuable feature but, in the end, it became only one of many aspects of the building that has generated faculty and student enthusiasm for the facility. Visitors to Gore Hall often cite the building's architecture or the graciousness of its public space as most noteworthy, while faculty focus on room geometry, technology, and the overall quality of the teaching environment as most valuable.

Room environment. Environmental room factors, while often not readily apparent, play a role in diminishing or improving the teaching and learning experience. Chief among these is the ability for a room to be quiet but not acoustically dead. The committee was ardent in insisting that teaching spaces must foster and not inhibit discussion. To do so, a room's ventilation must be exceedingly quiet. In Gore Hall, this was accomplished by installing oversized mechanical ducts that allow air to fall freely from the ceiling rather than be pushed. This simple design criterion has contributed significantly to improving the acoustical ambience of classrooms by eliminating the need for instructors and students to compete with excessive mechanical noise.

A more apparent room environment issue is that of lighting. Properly designed, it can augment lecture materials, while the reverse can be true if lighting is installed without considering faculty needs. The most common classroom lighting approach relies on a simple system of lights being all on or all off. Although this may be suitable for general lectures, it fails to address circumstances requiring visual display with simultaneous note taking. Operation of multilevel systems is often too complicated without prior working knowledge, especially in general-purpose classrooms where teaching faculty change each semester. Delaware tackled this problem when designing Gore Hall by implementing a lighting standard that could meet a variety of needs without being overly cumbersome. The standard offers three lighting levels: full lighting, no lighting, and zoned lighting. The latter has the ability to simultaneously accommodate note taking and visual projection. In the case of lighting a basic classroom, lighting levels are adjusted by preset wall switches and, in more technology-rich rooms, through preset dimmers integrated into the touch-screen display monitor in the instructor's podium.

These monitors provide users a variety of capabilities, including the ability to adjust light and sound levels, operate projectors and screens, select input and output sources, and, in some rooms, even raise and lower room-darkening shades. In rooms without a control podium, the touch-screen control monitors may be mounted on the wall or on portable desktop units. Another feature of the electronic instructor podium is the presence of a monitor that shows what is being projected on the screen. This permits the instructor to face the students at all times. Many faculty members prefer rooms with the electronic podiums because the faculty-technology interface is achieved from a single location and appears seamless to the student learner.

The Planning Process:

- Rely on forward-thinking leadership, cooperation, and synergistic planning strategies.
- Involve faculty in development and implementation of the plan.
- Offer an array of teaching technologies, from sophisticated to simple, to be distributed among a variety of classroom types and sizes.
- Include all aspects of technology, from skill-set development to equipment and connectivity.
- Encourage faculty self-sufficiency.
- Provide appropriate support and access to technology resources.
- Respond to changing technologies and teaching methods.
- Use phased implementation to capitalize on marketplace economies and increase the ability to link enhancements to the budget process and classroom renovation schedules.

Standards:

- Establish user-friendly, flexible, and easily mastered standards.
- Standardize equipment and controls.
- Change in response to evolving technologies and faculty skill development.
- Eliminate on-site repairs through repair by replacement.
- Install quiet mechanical systems in classrooms.

Faculty Expectations:

- Rise with increased mastery of technology.

Figure 13.4 Overview of the Planning Process

Conclusion

Seamless delivery and wide faculty acceptance and use of classroom technology have been goals for the University of Delaware since the mid-to-late 1980s, when the university initiated the first phases of its campus network and constructed its first three ITV classrooms and production studio. Since that time, the campus has been fully networked, and the university has expanded its ITV facilities, once limited to one central location, to multiple campus locations. However, it was Gore Hall that gave clear evidence that technology has truly become an integral part of the university's teaching and learning environment. Figure 13.4 provides an overview of the planning process used to create this technologically innovative building. In Gore Hall, all the elements of the broader technology planning effort are manifest in a cohesive and seamless integration of equipment, design, and faculty acceptance.

Bruce M. Taggart

14

Developing and Supporting High-Technology Facilities

Bruce M. Taggart is executive director, Office of Information Technologies, at Portland State University. Before becoming chief information officer at the university, he served for 10 years as the associate director of the University Computing Center at the University of Connecticut, where he received his Ph.D. in education. In recent years he has given presentations at several national and international conferences and was elected to the Northwest Academic Computing Consortium board in 1995 and to the executive committee in 1999.

In the past decade there has been a dramatic growth in the use of high technology in higher education to support and enhance student access, instructional delivery, research, public service, and university administration. Historically, at many universities and colleges, technology purchases were once handled out of "budget dust"—the scraps of money remaining after the other costs of running an institution had been taken care of (McCollum 1999). Most universities and colleges have recently seen technology expenditures and personnel support costs become an increasingly large percentage of the institutional operating and capital budgets. There are several technology expenditure categories that explain a large percentage of the growth in technology budgets. These include

- accelerated personal computer obsolescence and new microprocessor technology improvements;
- required high-speed network upgrades;
- growth in the use of Internet tools, applications, and related database technologies;
- institutional recognition of the need for faculty development related to the use and expansion of technology to enhance instructional delivery, research, and public-service outreach;
- increased competition and escalating salaries for high-demand technology support personnel; and
- need for new or retrofitted campus teaching facilities for faculty who now require multimedia technologies and Internet access for everyday classroom instruction.

While many universities and colleges have done their best to replace outdated computer workstations, upgrade the campus network, train faculty, and hire support staff, many campuses have been slow to fund the upgrading of traditional lecture-style classrooms with computer-based multimedia and Internet access for instructional delivery. A recent annual survey conducted by Kenneth C. Green, founder and director of the Campus Computing Project (www.campuscomputing.net), suggests that universities and colleges are continuing to find the middle ground between "high touch and high tech" in classrooms to enhance, but not replace, traditional lectures (Olsen 1999). The most recent Campus Computing Project survey data from 557 public and private colleges and universities in the United States indicates that 24.9 percent of all classes are being taught in computer-equipped classrooms and laboratories. The number of faculty using technology in the classroom is likely to grow dramatically across our campuses in the next three to five years as faculty become more aware of the possibilities of new technologies. Faculty participating in technology workshops have begun to request—or in some cases, demand—access to new technologies in the classroom. Senior university policy makers have also encouraged the development of distance education courses, and deans and department heads have begun to recognize and advocate the benefits and uses of technology in the curriculum.

Portland State University Case Study

Portland State University is Oregon's urban public university. The 49-acre campus adjoins the central business district of Portland, a city of 503,000. The Portland metropolitan area has a population of approximately 1.7 million. Founded in 1946 as the Vanport Extension Center of the Oregon State System of Higher Education, in 1955 the university became Portland State College, a separate degree-granting institution, and was renamed Portland State University in 1969. The Carnegie Foundation currently classifies PSU as a doctoral-granting university II. The fall 1999 head count enrollment, excluding extension students, was 16,041 (11,607 FTE), including 11,596 (8,567 FTE) undergraduate students and 4,445 (3,040 FTE) graduate students.

The university comprises the Colleges of Liberal Arts and Sciences and Urban and Public Affairs; the Schools of Business Administration, Engineering and Applied Science, and Fine and Performing Arts; the Graduate Schools of Social Work and Education; and Extended Studies. During the 1998–99 academic year, the university awarded 2,040 bachelor's degrees, 1,057 master's degrees, and 32 doctoral degrees. The university offers bachelor's degrees in 55 fields, certificate programs in 11 areas at the undergraduate level and in one area at the graduate level, master's degrees in 47 fields, and doctoral degrees in eight fields. In 1998–99 PSU awarded doctoral degrees in curriculum and instruction, educational leadership, electrical and computer engineering, environmental sciences and resources, social work, public administration and policy, systems science, and urban studies. During that same academic year, there were 586 budgeted instructional faculty FTE positions (including 49 FTE graduate assistants) and the student/faculty ratio was 21:1. More than 75 percent of full-time instructional faculty are tenured.

Technology and Organizational Development

Since 1995 the technology classroom support area at PSU has been evolving from a fairly fragmented organization involving several different areas (such as audiovisual services, television services, and help desk) into a single unit titled Technology Classroom Support Services (TCSS). The TCSS staff provides support for all types of classrooms, from low-technology classrooms to large, state-of-the-art, multimedia theater lecture halls. The TCSS unit's strategic location within Instruction and Research Services, a division of the Office of Information Technologies, helps define its primary support function.

The need for the TCSS to become integrated and focused on supporting faculty and new technologies in the classroom became evident as the result of several significant institutional policy directions, including the following:

- Senior university administrators, including the president, provost, and vice president for finance and administration, were in agreement on the institutional need to expand technology access for faculty and in the classroom.
- The university approved the design and construction of a new state-of-the-art 300-seat multimedia theater for large classroom instruction.
- The university was in the process of radically reforming its undergraduate curriculum for freshmen and sophomores. A critical element of the curriculum change was the inclusion of technology-enhanced instructional delivery supported by several new computer studios and electronic classrooms.
- The university provost established the Center for Academic Excellence to assist faculty with improving teaching, assessment, and the use of technology to enhance instructional delivery and scholarship.

With faculty's increasing requirements for new technology classrooms and related support services, there was a clear need for developing an organizational area that would plan, design, and support the growing number of technology-enhanced instructional delivery facilities.

As mentioned previously, the TCSS unit is the primary support entity at PSU for most of the technology classroom support. The different TCSS areas that make up the unit were developed as part of an overall campus reorganization of technology support services in 1995, focusing on faculty issues and enhanced instructional delivery utilizing technology. The final organizational structure that was put into place is impor-

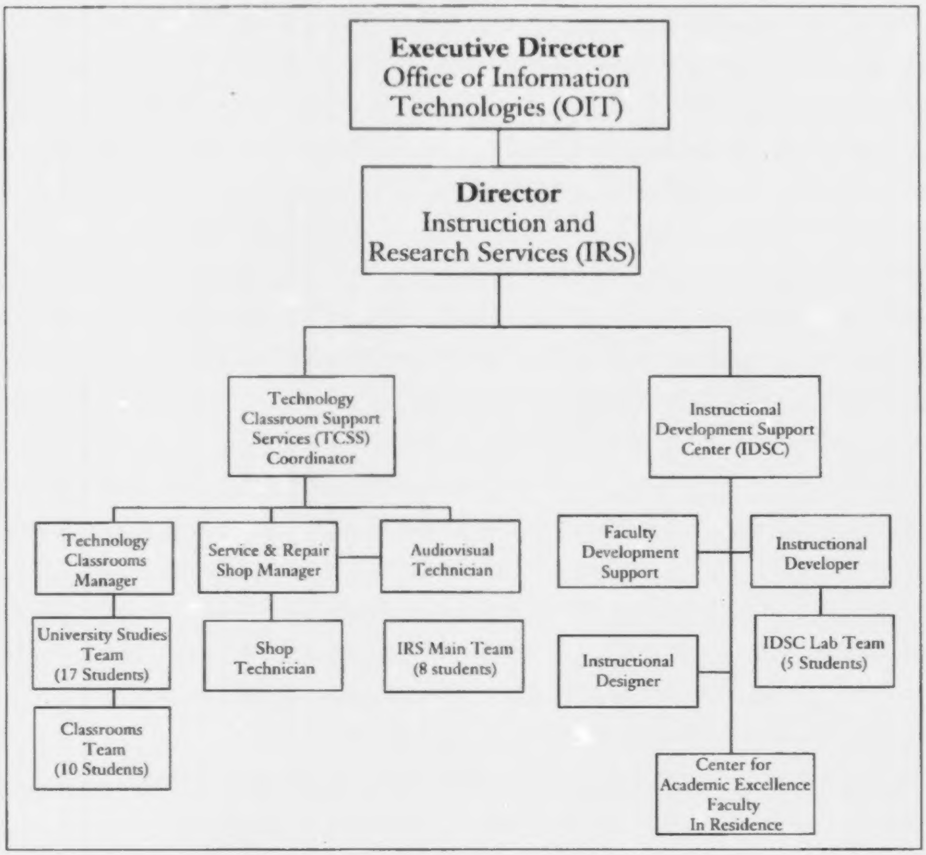
Executive Director
Office of Information Technologies (OIT)
Director
Instruction and Research Services (IRS)
Technology Classroom Support Services (TCSS) Coordinator
Instructional Development Support Center (IDSC)
Technology Classrooms Manager
Service & Repair Shop Manager
Audiovisual Technician
Faculty Development Support
Instructional Developer
University Studies Team (17 Students)
Shop Technician
IRS Main Team (8 students)
Instructional Designer
IDSC Lab Team (5 Students)
Classrooms Team (10 Students)
Center for Academic Excellence Faculty In Residence

Figure 15.1 Office of Information Technologies Organizational Chart

tant because it clearly defined where the university placed responsibility for technology support. The TCSS unit (see figure 15.1) is made up of five full-time professional staff and 35 well-trained student technicians. The TCSS areas have a historical base budget for technology classroom maintenance and repair supplemented with an annual allocation from the student technology fee.

Technology Classroom Models

Through the TCSS unit PSU has developed and adopted a planning support model that identifies seven different types of high-technology instructional facilities. These facilities include (1) technology-enhanced traditional lecture classrooms, (2) electronic classrooms, (3) computer-based teaching labs, (4) computer studios (seminar style), (5) collaborative learning technology labs, (6) distributed learning classrooms, and (7) high-technology lecture halls. Each of these technology-enhanced classrooms, labs, and lecture halls has distinct characteristics, capacities, and a targeted faculty/student audience. A layout and design description of each classroom, lab, and lecture hall, including design objectives and capabilities, is highlighted in the following paragraphs.

Technology-enhanced traditional lecture classroom. This classroom, as shown in figure 15.2, has a lecture or group-style setup with minimal technology, including a fixed overhead projector, a projection screen, and Ethernet computer connection available on the wall with dynamic network allocation. This room can handle many of the functions that high-technology classrooms can through mobile systems (that are available for checkout) and with some additional work to set up and break down the room.

Objectives

- Provide a network-ready classroom for portable laptop computers and mobile projection systems
- Present Web-based information or electronic presentations
- Gather and search the Web for information and answers during classroom interactions
- Support Web-based conferencing
- Use electronic tools that automate group-brainstorming processes
- Provide an environment where students can practice and improve their oral communication skills using technology
- Offer a friendly and robust facility with timely technical assistance

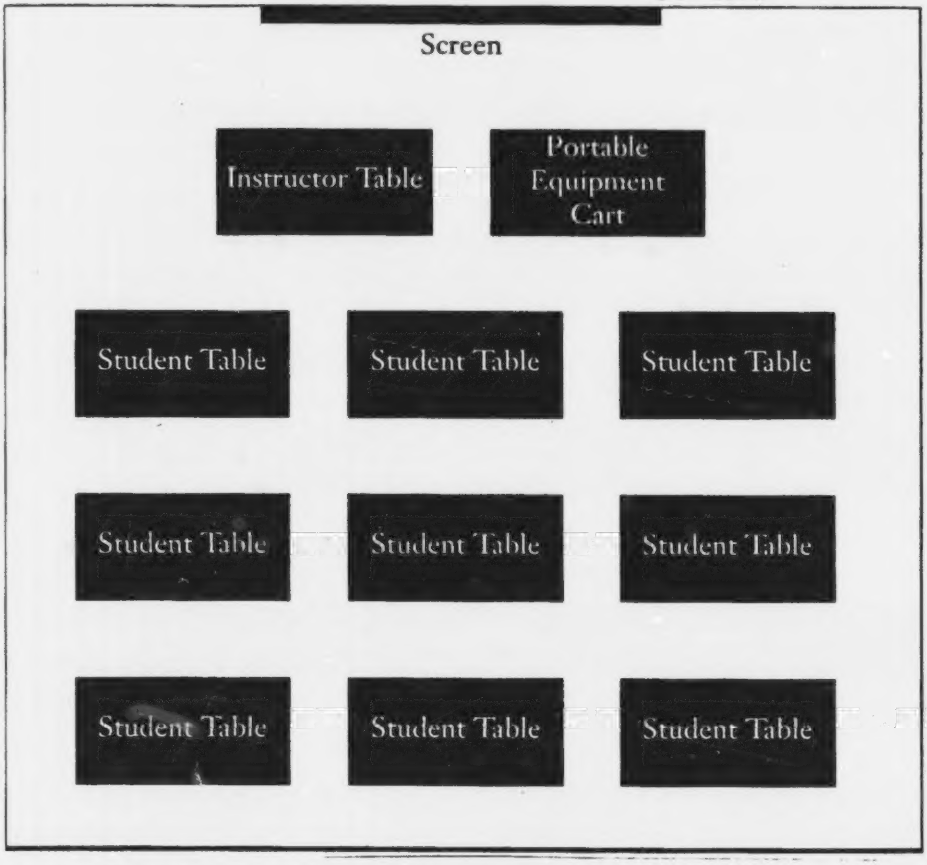

Figure 15.2 Technology-Enhanced Traditional Lecture Classroom Layout

Capabilities

- Set up for portable projection systems from laptop or other device
- Readily accepts peripheral devices and laptops
- Could easily be adapted to interact with digital devices for student feedback and interaction
- TVs mounted in place or closed-circuit connections available in room
- Full-screen projection of recorded material or closed-circuit system
- Can easily be used as a regular lecture-style classroom
- Manual computer and peripheral-switching capabilities
- Overhead projectors always available in room
- Fixed screens mounted both electrically and manually
- Ability to fully darken room

Electronic classroom. The electronic classroom, as shown in figure 15.3, is dedicated and equipped to provide presentation of multimedia from a Web-equipped computer through a fixed high-resolution projection system. The room may also be equipped with limited automated equipment-switching systems for other peripheral devices, such as a VCR, a document camera, laser discs, CD-ROMs, and an audio playback system.

Objectives

- Offer a flexible format and easily configurable room layout
- Make Web-based or electronic presentations with minimal setup
- Gather and search the Web for information and answers during classroom interactions
- Support Web-based conferencing
- Use electronic tools that automate group-brainstorming processes
- Provide an environment where students can practice and improve their oral communication skills using technology
- Offer a friendly and robust facility with immediate technical support

Capabilities

- Equipped with computer(s) fixed in place
- Readily accepts peripheral devices and laptops
- Fixed high-resolution projection system in place
- Easily adaptable for interactive digital devices for student feedback and interaction

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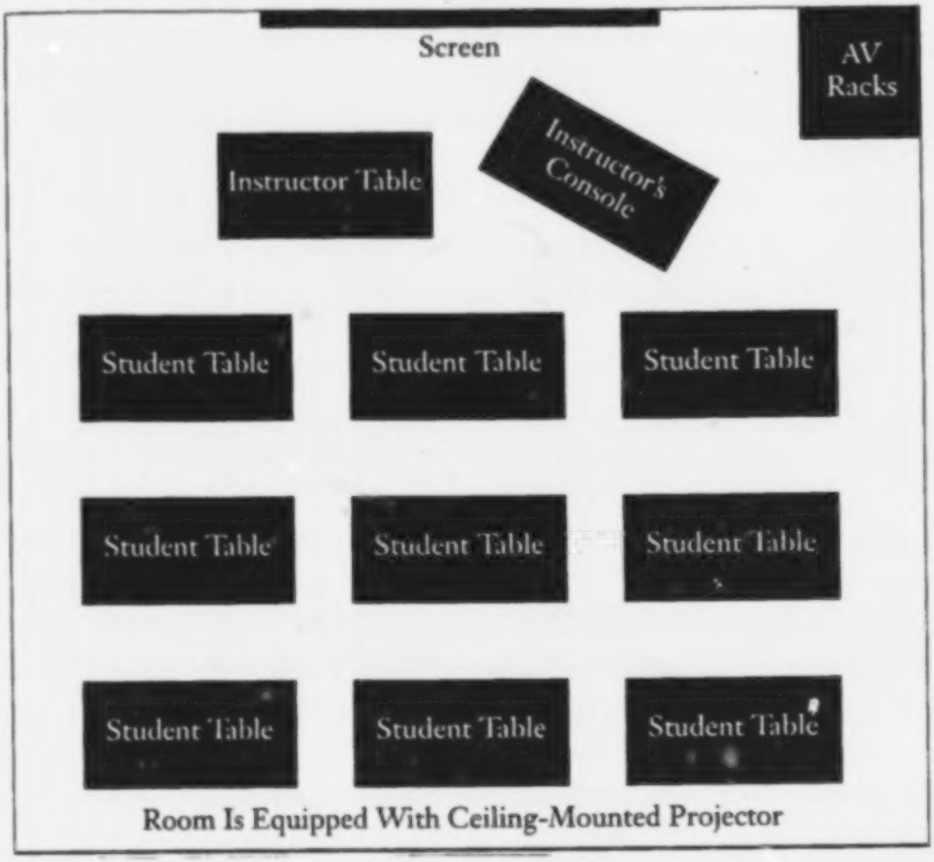
Screen
AV Racks
Instructor Table
Instructor's Console
Student Table
Student Table
Student Table
Student Table
Student Table
Student Table
Student Table
Student Table
Student Table
Room Is Equipped With Ceiling-Mounted Projector

Figure 15.3 Electronic Classroom Layout

- Full-screen projection of recorded material or closed-circuit video delivery
- Remote or manual control of camera for projecting classroom
- Connected for transmission via satellite, IP, fiber, cable TV, microwave, and institutional television services
- Can easily be used as a regular lecture-style classroom
- Permanently equipped with fixed VCR
- Manual computer and peripheral-switching capabilities
- Overhead projectors always available in room
- Fixed screens mounted both electrically and manually
- Support staff or telephone support available for immediate response
- Ability to fully darken room

Computer-based teaching lab. This type of classroom, as shown in figure 15.4, is organized in rows, usually for application instruction such as course software or Web browsing. The room features an instructor station and fixed projection, along with stations for each student to work during the class session.

Objectives

- Offer a flexible format and easily configurable room layout
- Present Web-based or electronic presentations with minimal setup
- Gather and search the Web for information and answers during classroom interactions
- Support Web-based conferencing
- Use electronic tools that automate group-brainstorming processes
- Promote group collaboration, electronic peer review, and group discussion
- Create an environment suited to instruction of software with teams of two or three learning together
- Include enough space for one computer to one person for learning software or inputting information
- Provide an environment where students can practice and improve their oral communication skills using technology
- Offer a friendly and robust facility with immediate technical support
- Can be used as an open computing lab when not scheduled for classes

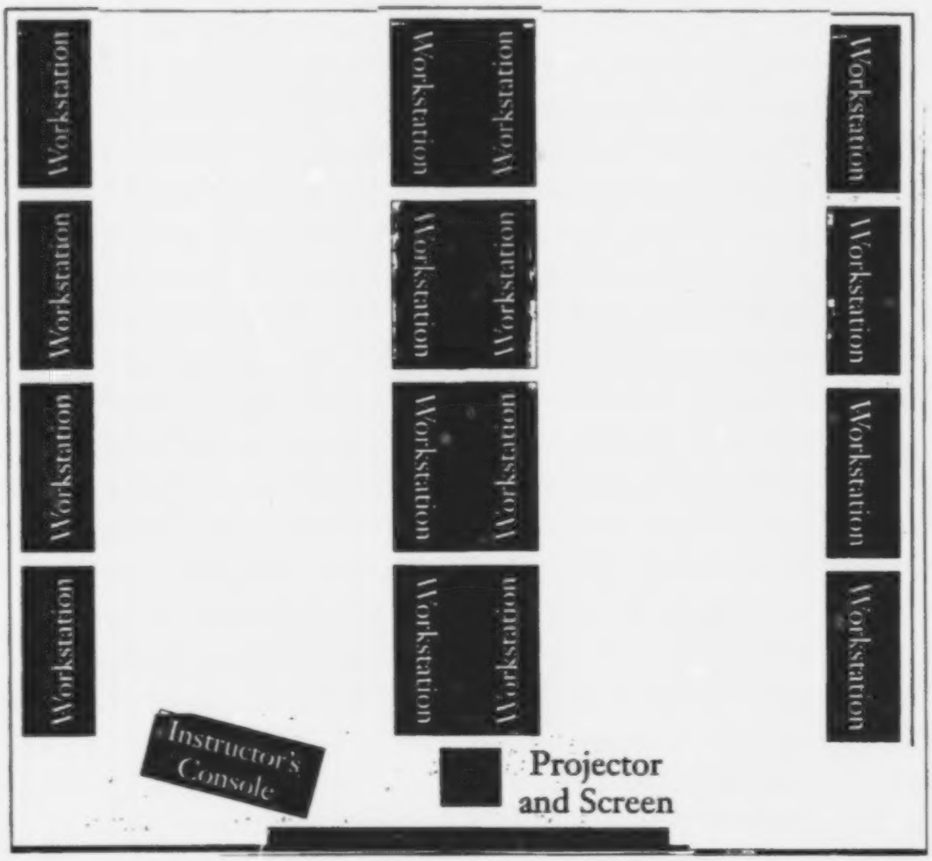
Workstation
Workstation
Workstation
Workstation
Workstation
Workstation
Workstation
Workstation
Workstation
Workstation
Workstation
Workstation
Workstation
Workstation
Workstation
Workstation
Instructor's Console
Projector and Screen

Figure 15.4 Computer-Based Teaching Lab Layout

Capabilities

- Equipped with computer(s) fixed in place
- Readily accepts peripheral devices and laptops
- Fixed high-resolution projection system in place
- Opportunity to view and project individual student screens from the instructor's station to the class
- Can easily be adapted to interact with digital devices for student feedback and interaction
- Full-screen projection of digital material or closed-circuit TV programming
- Can easily be used as a regular lecture-style classroom
- Manual computer and peripheral-switching capabilities
- Fixed screens mounted both electrically and manually
- Support staff or telephone support available for timely technical assistance

    - Ability to fully darken room

Computer studio (seminar style). The computer studio (seminar style), as shown in figure 15.5, is organized with computers facing the wall on the outer perimeter of the room and includes an instructor station with projection capabilities. Tables are generally located in the center of the room for collaborative discussion and work, along with constant interactions between computer systems. PCs may be used individually or with small groups during this process.

Objectives

- Offer a flexible format and easily configurable room layout
- Present Web-based or electronic presentations with minimal setup
- Gather and search the Web for information and answers during classroom interactions
- Support Web-based conferencing
- Use electronic tools that automate group-brainstorming processes
- Promote group collaboration, electronic peer review, and group discussion
- Can break into small groups and develop ideas that can be compared and contrasted during class
- Create an environment suited to instruction of software with teams of two or three learning together
- Include enough space for one computer to one person for learning software or inputting information
- Provide an environment where students can practice and improve their oral communication skills using technology

- Offer a friendly and robust facility with immediate technical support
- Provide an environment for running working simulations to demonstrate real-life conditions
- Can be used as an open computing lab when not scheduled for classes

Capabilities

- Equipped with computer(s) fixed in place
- Readily accepts peripheral devices and laptops
- Fixed high-resolution projection system in place
- Opportunity to view and project individual student screens from the instructor's station to class
- Can easily be adapted to interact with digital devices for student feedback and interaction
- Full-screen projection of digital material or closed-circuit TV programming
- Can easily be used as a regular lecture-style classroom
- Manual computer and peripheral-switching capabilities
- Fixed screens mounted both electrically and manually
- Support staff or telephone support available for timely technical assistance
- Ability to fully darken room

Collaborative learning technology lab. The collaborative learning technology lab (see figure 15.6) accommodates two or three individuals for each computing workstation. This room features an instructor station that can project any individual station's work to the class. This lab allows for small-group interaction and work for simulations, group study, an improved application learning environment, and small- and large-group comparisons.

Objectives

- Present Web-based or electronic presentations with minimal setup
- Gather and search the Web for information and answers during classroom interactions
- Support Web-based conferencing
- Use electronic tools that automate group-brainstorming processes
- Promote group collaboration, electronic peer review, and group discussion
- Can break into small groups and develop ideas that can be compared and contrasted

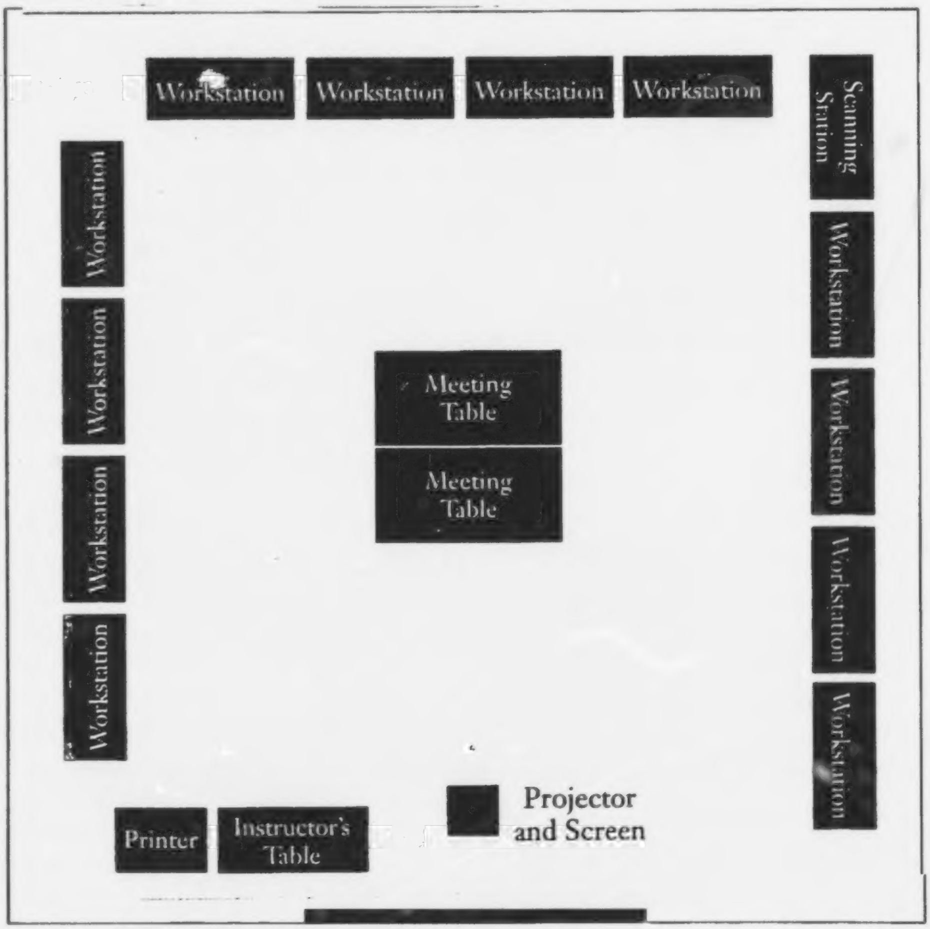
Workstation
Workstation
Workstation
Workstation
Scanning Station
Workstation
Workstation
Workstation
Workstation
Workstation
Workstation
Workstation
Workstation
Meeting Table
Meeting Table
Projector and Screen
Printer
Instructor's Table

Figure 15.5 Computer Studio (Seminar Style) Layout

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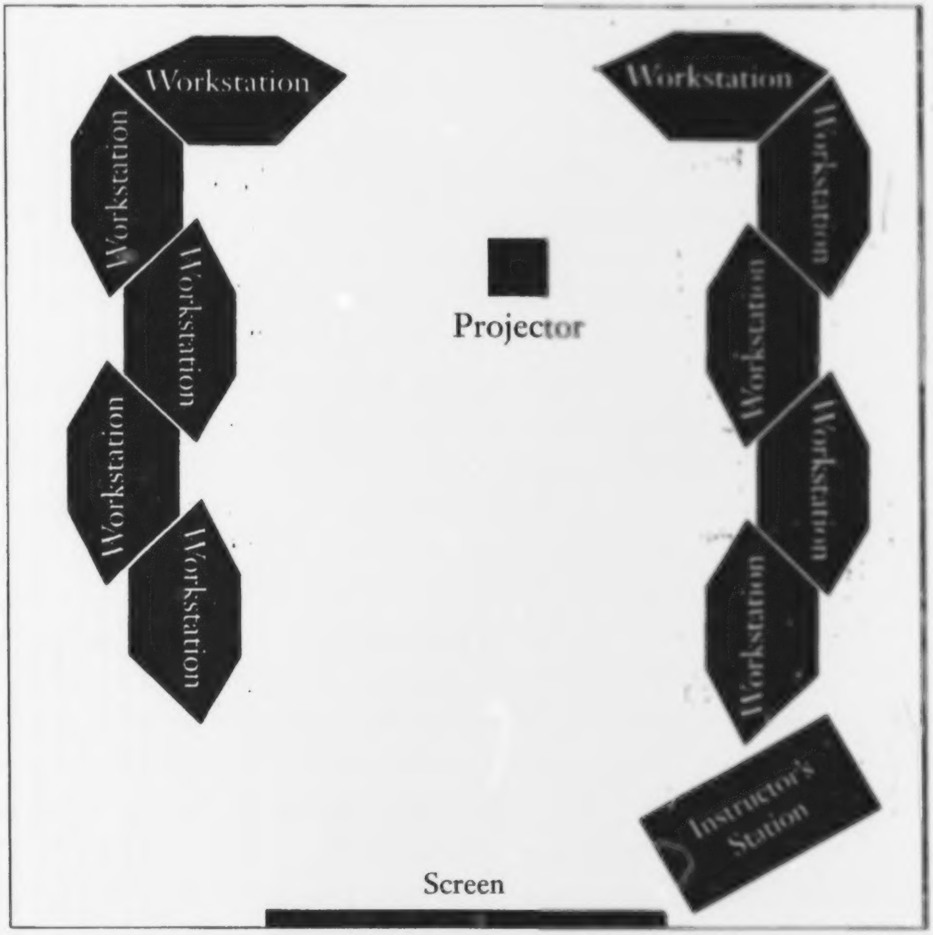

Figure 15.6 Collaborative Learning Technology Lab Layout

- Create an environment suited to instruction of software with teams of two or three learning together
- Include enough space for one computer to one person for learning software or inputting information
- Provide an environment where students can practice and improve their oral communication skills using technology
- Offer a friendly and robust facility with immediate support if necessary
- Offer technology that is as transparent as possible for distributed delivery to other sites
- Provide an environment for running working simulations to demonstrate real-life conditions
- Can be used as an open computing lab when not scheduled for classes

Capabilities

- Equipped with computer(s) fixed in place
- Readily accepts peripheral devices and laptops
- Fixed high-resolution projection system in place
- Opportunity to view and project individual student screens from instructor's station to the class
- Could easily be adapted to interact with digital devices for student feedback and interaction
- Full-screen projection of recorded material or closed-circuit TV system programming
- Manual computer and peripheral device-switching capabilities
- Fixed screens mounted both electrically and manually
- Support staff or telephone support available for timely technical assistance
- Ability to fully darken room

Distributed learning classroom. The distributed learning classroom, as shown in figure 15.7, is prepared primarily for two-way video and audio connection with remote classrooms of similar capabilities. The classroom can be used either to originate or to receive a televised class. In a distributed learning classroom, classes can be provided through a desktop-to-desktop connection via computers.

Objectives

- Provide an environment where students can practice and improve their oral communication skills using technology

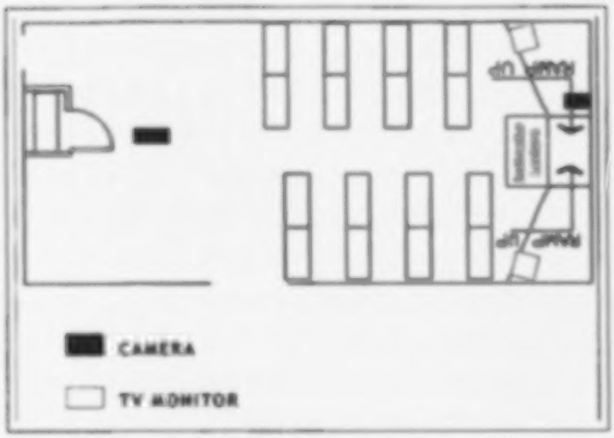

Figure 15.7 Distributed Learning Classroom Layout

- Offer a friendly and robust facility with immediate technical support
- Provide a network-ready classroom for portable laptops and mobile projection systems
- Offer a teaching and learning environment for remote students to participate in classroom instruction
- Provide a high-quality acoustic environment to avoid feedback and problems in transmission
- Deliver courses statewide to or from PSU
- Able to record audio/video of lectures
- Offer transparent technology that is as transparent as possible for distributed delivery to other sites

Capabilities

- Readily accepts peripheral devices and laptops
- TVs mounted in place for closed-circuit feedback
- Microphones for student interaction and feedback
- Remote or manual control of camera for projecting classroom
- Connected for transmission via satellite, IP, fiber, cable TV, microwave, and institutional television services
- Can easily be used as a regular lecture-style classroom
- Permanently equipped with fixed VCR
- Fixed document camera, laser disc, and audiotape system
- Provides proper lighting conditions for camera and transmission
- Automated computer and peripheral-switching capabilities
- Manual-switching capabilities
- Fixed screens mounted both electrically and manually
- Support staff or telephone support available for immediate response
- Ability to fully darken room
- Could easily be adapted to interact with digital devices for student feedback and interaction

High-technology lecture hall. The high-technology lecture hall, as shown in figure 15.8, is a classroom prepared primarily for lecture-style presentation and is fully equipped with automated system controls, fixed single or multiscreen projection, and automated switching mechanisms. It has a full complement of computing systems and many peripheral devices, including a document camera; CD-ROM; DVD; and audiotape, videotape, and broadcast capability with mobile camera equipment.

Objectives

- Make Web-based or electronic presentations with minimal setup
- Gather and search the Web for information and answers during classroom interactions
- Support Web-based conferencing
- Use electronic tools that automate group-brainstorming processes

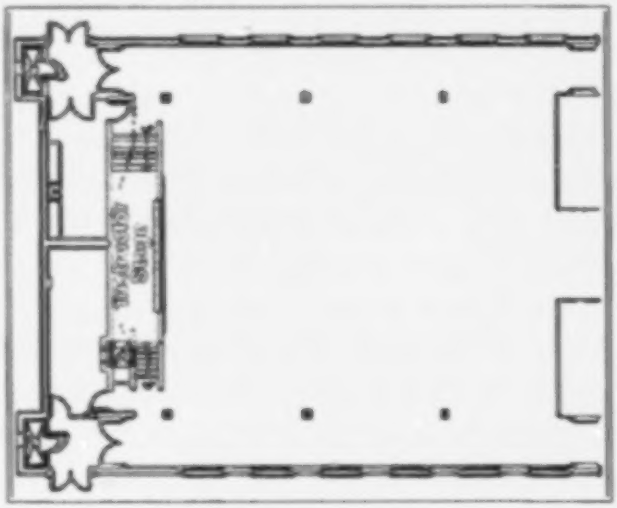

Figure 15.8 High-Technology Lecture Hall Layout

Electronic Classrooms	Traditional Lecture Classroom	Technology-Enriched Classroom	High-Technology Classroom	Computing Studio	Computing Classroom	Collaborative Learning Classroom	Distributed Learning Classroom
Objectives							
Offer a flexible format and easy configurable room layout.	x	x	x	x	x	x	x
Include two-way audio/video systems for remote students to participate in classroom instruction.		x	x	x	x	x	x
Present Web-based or electronic presentations with minimal setup or hassle.	•	x	x	x	x	x	
Gather and search the Web for information and answers during classroom interactions.	•	x	x	x	x	x	
Support Web-based conferencing.	•	x	x	x	x	x	
Include enough space for one computer to one person for learning software or inputting information.	•	x	x	x	x	x	
Promote group collaboration, electronic peer review, and group discussion.				x	x	x	
Can break into small groups and develop ideas that can be compared and contrasted during class.				x		x	
Create an environment suited to instruction of software with teams of two or three learning together.				x	x	x	
Provide an environment where students can practice and improve their oral communication skills using technology.	•	x	x	x	x	x	•
Offer a friendly and robust facility with immediate support if necessary.	•	x	x	x	x	x	x
Provide network-ready classrooms for portable laptops and mobile projection systems.	x						x
Offer a teaching and learning environment for remote students to participate in classroom instruction.							x
Offer technology that is as transparent as possible for distributed delivery to other sites.			x			x	x
Provide a high-quality acoustic environment to avoid feedback and problems in transmission.			x				x
Provide an environment for running working simulations to demonstrate real-life conditions.	•	x	x	x	x	x	x
Offer workshops for faculty to improve their knowledge of technology in pedagogy.		x	x	x	x	x	
Deliver courses statewide to or from PSU.							x
Can be used as an open computing lab when not scheduled for classes.				x	x	x	
Able to record audio/video of lectures.							x

X = Readily Available   • = Available With Modified Effort

Table 15.1 Portland State University's Seven Models for Technology-Enhanced Classrooms

- Provide an environment where students can practice and improve their oral communication skills using technology
- Offer a friendly and robust facility with timely technical assistance
- Provide a network-ready classroom for portable laptops and mobile projection systems
- Include two-way audio/video systems for remote students to participate in classroom instruction
- Offer technology that is as transparent as possible for distributed delivery to other sites

Capabilities

- Equipped with computer(s) fixed in place
- Readily accepts peripheral devices and laptops
- Multiple fixed or higher projection system in place
- Could easily be adapted to interact with digital devices for student feedback and interaction
- Full-screen projection of recorded material or closed-circuit TV system delivery
- Microphones for student interaction and feedback
- Remote or manual control of camera for projecting classroom

Electronic Classrooms

Capabilities	Traditional Lecture Classroom	Technology-Enriched Classroom	High-Technology Classroom	Computing Studio	Computing Classroom	Collaborative Learning Classroom	Distributed Learning Classroom
Setup for portable projection systems from laptop or other device.	x						
Equipped with computer(s) fixed in place.		x	x	x	x	x	
Readily accepts peripheral devices and laptops.	x	x	x	x	x	x	x
Fixed projection system in place.		x	x	x	x	x	
Opportunity to view and project individual student screens from instructor's station to class.				x	x	x	
Could easily be adapted to interact with digital devices for student feedback and interaction.	•	x	x	x	x	x	x
TVs mounted in place for closed-circuit feedback.	•						x
Full-screen projection of recorded material or closed-circuit system.	x	x	x	x	x	x	
Microphones for student interaction and feedback.			x				x
Remote or manual control of camera for projecting classroom.		x	x				x
Connected to satellite, IP, fiber, backfeed cable, microwave, ITFS, etc.		x	x				x
Can easily be used as a regular lecture-style classroom.	x	x	x	x			x
Permanently equipped with fixed VCR.		x	x				x
Fixed document camera, laser disc, and audiotape system.			x				x
Provide proper lighting conditions for camera and transmission.			x				x
Automated-switching capabilities.			x				x
Manual-switching capabilities.	•	x	x	x	x	x	x
Overhead projectors always available in room.	x	x	x				
Fixed screens mounted both electrically and manually.	x	x	x	x	x	x	•
Support staff or telephone support available for immediate response.		x	x	x	x	x	x
Ability to fully darken room.	•	x	x	x	x	x	x

X = Readily Available • = Available With Modified Effort

Table 15.1 Portland State University's Seven Models for Technology-Enhanced Classrooms

- Connected for transmission via satellite, Internet, fiber, microwave, and institutional TV services
- Can easily be used as a regular lecture-style classroom
- Permanently equipped with fixed VCR, document camera, laser disc, and audiotape system
- Provide proper lighting conditions for camera and transmission
- Automated computer and peripheral-switching capabilities
- Manual-switching capabilities
- Document camera integrated into the projection system(s)
- Fixed screens mounted both electrically and manually
- Support staff or telephone support available for timely technical assistance
- Ability to fully darken room

These seven defined models for technology classrooms have become de facto standards at PSU for planning and discussion purposes. When a TCSS staff or faculty member references a computer studio or collaborative learning lab, there is a general understanding of what type of facility the individual is talking about. Table 15.1 provides an overview of the seven models and their objectives and capabilities.

Planning and Support

One of the key elements in any planning process, technology or otherwise, is to include a broad cross-representation of the campus community to invite input into how the facility should be developed. The most successful technology facility upgrades at PSU have included predesign input from faculty, students, technical staff, and the facilities professionals. From a technology planning perspective, the professional staff members of the Instruction and Research Services area, including the TCSS, have developed a simple checklist for items that they find useful to define and assess user requirements and recommend a particular type of electronic classroom or computing studio for a specific class. This includes identifying and documenting the following:

- **Pedagogical goals.** Understand expected learning outcomes, teaching style (lecture, interactive, collaborative, group, or individual), and resources needed outside class.
- **Technologies.** Review of latest technologies needed, along with overhead projectors, slide projectors, laptops, and other devices.
- **Requirements for room design.** Type of room (i.e., computing studio, distributed education classroom, computing classroom, technology classroom, collaborative classroom), class size, networking, audio needs, and desktop connections.
- **Instructor area arrangement.** Lectern location, barriers between faculty and students, teaching style, ease of use, instructor work space, and flexibility.
- **Blackboards and whiteboards.** How much space, where the board is located, blackboards versus whiteboards, electronic whiteboards, and portable writing systems.
- **Acceptable user interface.** What level of switching is needed, how technologically experienced the user is, and what systems are in place on campus that are compatible with the faculty member's technical expertise and instructional delivery objectives.
- **Computing.** Equipment and operating systems, software, video transmission interface, peripheral devices, level of experience, frequency of use, additional help needed, etc.
- **Slide and overhead projectors.** How many, where to locate, optical needs, and frequency of use.
- **Expected support and training.** Level of support, level of training, development, and available workshops.

Technologies

All electronically enhanced classrooms should have a minimum baseline configuration that faculty can come to expect in a technology-designated classroom. It is critical that all classroom technology components supporting faculty instructional delivery be periodically tested for operational reliability. It is also essential that classroom technology be periodically assessed and tested for compatibility with current software releases and faculty instructional requirements. It is not uncommon for faculty to bring a new software release into a technology-enhanced classroom and have it not work just before a class begins. Therefore, it is recommended that classroom technology be periodically tested for reliability and operational compatibility with new software, at least on a quarterly basis, as part of the life-cycle planning process for technology facilities. The following technologies are generally found in all of PSU's technology-enhanced classrooms and are included in the university's life-cycle facilities planning process.

- **Computers.** 96 Meg RAM, Pentium III 500 MHz, G3 400 MHz, DVD/CD-ROM drive, Zip drive, 10/100 BASET, 4 GB hard drive, 8Meg VRAM, and multimedia capability.
- **Software.** MS Office, Netscape, Telnet, Novell GroupWare, GroupWise, Inspiration, and specific loads for instructor's individual needs.
- **AV components.** SVHS player, document camera, laser disc and barcode reader, slide digitizers, screens, general audio systems, slide projection and overhead systems, and video transmission archival system.

Operating and Capital Budget Issues

It comes as no surprise to any budget or finance person in higher education that technology labs, classrooms, and network infrastructures are very expensive to plan, develop, and maintain. Planning for the acquisition, enhancement, and replacement of technology resources has become an integral part of most institutions' budgetary processes. Providing an information technology infrastructure must be dealt with in the same way that supporting the library and providing and maintaining buildings and a utility infrastructure has been dealt with in the past (Foster and Hollowell 1999). Therefore, the planning process for any new or retrofitted technology teaching facility should include a formal financial analysis identifying both short-term operating expenses and projected long-term life-cycle upgrades for the facilities. This financial needs analysis for the life-cycle of the facility should be communicated to the senior university administration, including the provost, the vice president for finance and administration, and the director of campus facilities. As campuses annually add new technology classrooms to keep pace with faculty demands for technology in the classroom, the issue of life-cycle capital planning to replace a growing number of antiquated classroom computers and projection systems looms on the horizon as a massive balloon payment as technology change accelerates each month. This needs analysis for the replacement of technology infrastructure should be included as part of the institution's annual budgetary planning. It is recommended that budgetary planning for classroom technology upgrades be incorporated into both the annual operating budget cycle and the three-to-five-year capital budget planning process.

Classroom Support

Support for high-technology classrooms is critical to the overall success or failure of a facility to meet its intended objectives. The issue of support for high-technology classrooms has two main components, the first being the faculty development support that instructors receive prior to teaching in a multimedia environment. Timely technical assistance for faculty if a problem occurs prior to or during the class is the second key component of support for such classrooms. Both faculty development and timely on-site technical assistance are crucial in determining to what extent a new technology classroom is perceived as successful and in what manner the facility is utilized. If faculty are not highly trained to use a multimedia classroom or if there are technical problems with the day-to-day classroom operation of the technology without timely assistance, then, more often than not, the technology classroom will not be used effectively or efficiently. There are many instances where faculty who have been poorly trained or have very little confidence that the classroom technologies are fault-tolerant will choose not to utilize the high-technology resources and revert to primarily traditional lecture style instructional delivery. Most of the technology classrooms at PSU are equipped with phones to provide faculty with timely access to technical support staff in the event there is a problem with classroom equipment.

Faculty have begun to request—or, in some cases, demand—access to new technologies in the classroom.

For faculty working in technology-enhanced classrooms, one of the key issues is to have an installed base level of technology so that they don't have to bring devices with them and spend too much time setting them up. Any lengthy technology set-up requirements prior to a class lecture usually result in a high frustration level and a low level of technology usage. Faculty have stated repeatedly that technology setup should not take away from class time. If it does, they will be less likely to use the technology at all.

Based on recent feedback from faculty on what technologies worked or did not work in the classroom, PSU faculty agree that several classroom design components are important to their respective instructional deliveries. These successful design components include

- easily movable tables and chairs for flexible classroom layouts;
- dimmer switches for room light control;
- a traditional audiovisual overhead available in the room for backup usage;
- a fixed, overhead-mounted video projection system;
- high-quality vertical room blinds to control outside lighting; and
- a fixed electronic faculty podium that includes room lighting control, a networked personal computer, VCR, laser disc player, and audio tape player unit.

Faculty Development

At PSU, the provost and the deans in the School of Liberal Arts and Sciences (as well as the professional schools) have emphasized faculty development, a key factor in the growth of technology use in the curriculum. In 1996 the provost created the Center for Academic Excellence (CAE), with its primary goals to help faculty improve how they teach, build course assessments, and assist with incorporating technology into the curriculum. The staff of the Office of Information Technologies (OIT)/ Instruction and Research Services (IRS) area team teach many of the CAE's faculty workshops and institute activities. The OIT/IRS area includes three professional staff with Ph.D.'s in instructional design. The pedagogical/technology partnership between CAE and OIT/IRS has provided faculty with both theoretical and applied uses of technology to enhance how they teach and deliver instructional materials. Close to 50 percent of the full-time faculty at PSU have participated in these workshops. Many of the technology workshops take place in the actual technology classrooms where the faculty will be teaching. This gives the faculty hands-on experience in using the technology in a mock classroom scenario. This preclass usage of the high-technology classrooms, coupled with the CAE training on course design and assessment, has dramatically increased the use of technology within the curriculum and decreased faculty concerns and fears of teaching live with new technology.

The positive effect of teaching with technology in the classroom has been well documented at PSU by faculty who have participated in CAE/OIT faculty development initiatives. Scott Burns, a professor of geology at PSU, comments:

> I love teaching with technology in the classroom because it really enhances students' comprehension. Geology is very visual, so I show slides or diagrams of all the examples that I talk about. Being connected to the Internet is also important because I can to go a Web site about a current event to show photos of what is happening. If a volcano blows or an earthquake occurs or a landslide happens, there immediately will be a site on the Web to look at, followed by some discussion. Current events has never been this good!

Nancy Bowers, an environmental sciences instructor, also notes:

> I never really fully realized the capabilities and potential of teaching in a "hi-tech" classroom until I was teaching about stream hydrology and the effect of clear-cutting. With an Internet connection and computer display, I could actually show the students hydrographs from real watersheds in the region in real time. The U.S. Geological Survey Web site provides access to real-time stream data and allows the user to view a graphical representation of stream flow in relationship to rainfall. On further thought, I realized that I had missed a number of opportunities where I could have enriched my teaching had I been in a hi-tech classroom. Since that experience, I now request to teach in a hi-tech classroom whenever I get an opportunity.

Assessing Technology Outcomes in the Classroom

Throughout the country, institutions of higher education are budgeting and spending millions of dollars on new technologies and related infrastructure improvements to enhance student access for their campuses and to better support faculty instructional delivery, research, and public-service outreach. As we are in a technologically advanced society, the subject of information technology tops the agenda of almost every college and university, where the aggressive utilization of technology is seen as an indicator of a progressive institution (Kobulnicky 1999). However, all of the increases in technology spending are not going unquestioned.

As a result of the overwhelming increase in activity requiring technological support in our universities and colleges, there has been a groundswell of interest in and demand for assessment of technology projects and their impact on the university's most fundamental mission—teaching and learning (Taylor and Eustis 1999). For the past decade, institutions of higher education have been struggling through severe budget cuts and external questions as to whether or not colleges and universities were meeting their stated objectives. As we face a new decade of increasing technology requirements for faculty and students as well as limited operating budgets, the issue of assessment becomes critical in supporting and justifying new technology expenditures. As budgetary resources become scarce for new campus projects, every dollar allocated for technology improvements translates into other nontechnology initiatives being funded at a lower level or not at all. Eventually, each university should and must present a coherent picture of any high-level technology project or related initiative to other faculty, upper administration, external boards, governmental agencies, legislators, and parents (63). A good assessment plan that is integrated in the technology planning process can help address most of the questions and serve as a vehicle for communicating project results to both internal and external constituencies.

One of the key elements in any planning process is to include a broad cross-representation of the campus community.

As stated earlier, many universities are facing the same institutional assessment issue related to teaching, student learning, and technology. Given all the other demands on faculty and staff, the challenge of assessment can be overwhelming. Where to start is important. There are two excellent studies in the research literature that look at the issue of information technology and assessment. In one study, the Coalition for Networked Information (CNI) invited institutions of higher education in December 1996 "to use ongoing assessment techniques to study the uses, impacts, costs, and effectiveness of networks and networked resources and services" (63). A second study to note is the Flashlight Project (67). At many conferences and faculty meetings, the same questions are asked: Is technology enhancing student learning? Are technologies being added to the curriculum cost-effectively? The Flashlight Project provides a useful approach and tool for answering these questions. The Flashlight Current Student Inventory uses as its basis a set of acknowledged principles of learning that closely overlap with the "seven principles of good practice in undergraduate education," developed by Chickering and Gamson (1987; 1991, 68). (For the technology applications of these principles, see Chickering and Ehrmann [1996]). What is important about the Flashlight Project is that it does not focus on the technology per se but rather on the pedagogical questions, instructional design, and their impact on the learning environment.

The key issues with assessment are where to get the time to do it and whether you have the skills to undertake a valid and reliable technology assessment project. The purpose of an assessment is to collect useful data, both qualitative and quantitative, to determine whether or not certain intended project objectives are being accomplished. The key is to get started with assessment and have it become a part of organizational culture. At PSU we use an assessment hybrid of both quantitative and qualitative questions to assess the impact of technology in classroom instruction, student learning, and faculty satisfaction with technology. The technology assessment processes are both formal and informal and spread throughout the professional schools and colleges as well as the central IT support area.

Post-course completion assessment and feedback are important parts of supporting faculty using high-technology classrooms. Assessment of technology in the classroom at PSU is focused on three primary areas. The first area of classroom technology assessment deals with the following question: To what extent and in what manner are faculty prepared to teach successfully with various technologies in the classroom? The 1999 Campus Computing Project survey of senior IT officials indicated that nearly 40 percent of the respondents noted that helping reluctant faculty members bring technology into their teaching was the biggest challenge of their jobs (Olsen 1999). The second area of technology classroom assessment concerns the extent to which the technology did or did not meet the intended instructional delivery outcomes of the faculty member. The third area of assessment, and the most important, relates to the extent, that and manner in which, the technology enhanced the student learning outcomes for a particular course.

There are four primary methodologies used at PSU for obtaining feedback from faculty to identify what worked, what did not work, or what should change or be added to make the technology classroom more effective for teaching. They include

- faculty-developed quantitative and qualitative course analyses;
- an e-mail or hard-copy satisfaction survey to faculty soliciting their feedback for positive and negative use of the technology classrooms;
- focus groups with a cohort of faculty using the same high-technology facility; and
- one-to-one meetings with lead faculty using high-technology classrooms.

Several faculty have recently completed assessments on the impact of technology in the classroom in improving student learning outcomes. Tucker Childs, an associate professor of applied linguistics at PSU, used computer software to teach students how to speak English using acoustic analysis. Childs documented that using technology in the classroom to teach rather dull, vapid, and abstract "acoustic phonetics" resulted in more active involvement of students, which enriched their learning process and content understanding. Sandra Rosengrant, a professor of Russian, enriched her Russian Culture and Civilization class by using high-resolution computer graphics, musical excerpts, and film clips. These technologies allowed Rosengrant to cover more materials than through traditional lectures, and students found class discussion easier to follow. Students who completed this course were of the unanimous opinion that they could not have covered as much material or understood it nearly as well without the multimedia approach. Students were particularly enthusiastic about the immediacy and richness of the classroom experience.

There is a large body of anecdotal information and data that technology is enhancing the overall learning outcomes of students on our campuses. But there have been few quantitative studies that prove that there is a statistically significant difference in student learning with technology than without it. There is an interesting quantitative study (Perrin and Rueter 1998) that showed that technology does have an impact on student learning, but it depends on the characteristics of the course. In some courses, students perform better with technology enhancements; in some traditional courses, students perform better without technological enhancements; and in some instances, neither technology nor traditional methods resulted in students' performing better on common exam questions. It is important to note that what Perrin and Rueter found were common characteristics of technology courses where students performed better on common exam questions in comparison to the performances of students who attended traditional lectures. Those characteristics included

- content that was very visual and/or three dimensional;
- a comprehensive use of Web sites; and
- instructors who used technology in the classroom to its full potential.

The same study found that students in traditional courses scored significantly higher on common exam questions than those in technology-enhanced courses where the course had at least one of the following characteristics:

- the content was problem solving in nature;
- the instructor was uncomfortable using technology; or
- the instructor was overconfident of the benefits of technology.

While much of the data on how effective classroom technology is in enhancing student learning is anecdotal and qualitative, universities and colleges should be gathering data to assess the impact of technology on their students and to justify the additional expenses associated with new technologies. Both quantitative data and qualitative data on technology-related learning outcomes are critical to sustaining the budgetary support for maintaining and expanding campuswide technology resources.

Summary

In the past decade, colleges and universities throughout the country have spent millions of dollars in upgrading their respective technology infrastructures, including campus network upgrades, new student computer labs, faculty workstation replacements, and retrofitted traditional lecture-style classrooms with high-technology multimedia equipment. While many institutions have upgraded their campus networks and replaced antiquated personal computers throughout their campuses, they have either delayed or ignored upgrading traditional classrooms with new multimedia technologies for enhanced faculty instructional delivery. As more faculty become knowledgeable about the use of multimedia and the Internet, and incorporate technology in their curricula, many campuses face a bottleneck when the demand for technology-enhanced classrooms far exceeds the capacity of technology classrooms.

In the mid-1990s the senior administration of PSU began to plan strategically for adding new technology classrooms throughout the campus to support the growing faculty need for computer-assisted instructional delivery and to support a major revision of the freshman and sophomore core curriculum, which was to be heavily dependent on technology. In the past five years, PSU has been successful in developing more than 20 new high-technology classrooms, based on the seven models discussed earlier in this chapter, to support faculty instructional delivery and student learning.

The issue of assessment is critical in supporting and justifying new technology expenditures.

From a PSU case study model, the keys to the successful planning, development, and support of high-technology classrooms throughout the campus are the following:

- Inclusive predesign planning of facilities involving a broad cross section of the campus community, including faculty, students, technical support staff, and professional facilities planners.
- Partnering with the provost's CAE on faculty instructional development programs focusing on pedagogy, assessment, and incorporating technology in the curriculum.
- Developing a realistic and confirmed operating budget and life-cycle capital budget process to support the long-term viability of the facilities' use.
- Requiring faculty development and training on all technologies in the new electronic classrooms to minimize frustrating and oftentimes unproductive technical assistance calls during an actual class period.
- Recruiting and retaining technical support staff who are cognizant of both the technical capacities of the classroom and the pedagogical needs of the faculty user.
- Working with faculty who are using new technology classrooms to obtain feedback and assess the impact, if any, of technology on the student learning process. This data, both quantitative and qualitative, is critical for supporting future expenditures on campuswide technology.

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Patricia Seller-Wolff and Mark Wells

Planning Practice

RICE UNIVERSITY

FROM BLUEPRINTS AND SPREADSHEETS TO THE WEB

Patricia Seller-Wolff is currently the head of strategic planning at Kirksey and Partners Architects. She was formerly a space analyst in the Facilities and Engineering Department at Rice University.

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In 1997, Rice University started implementing a 10-year strategic facilities plan that includes more than $300 million in infrastructure, additions, and new buildings for its 3 million square feet, 57 buildings, 2,600 undergraduate students, and 1,400 graduate students. All departments, especially the facilities department, use a space inventory to determine space needs and assignments and for indirect cost reporting.

The vision for the space inventory was to provide a constantly updated space planning tool for campus strategic planning. To reach this goal, the information needed to be available to those who update it as well as those doing the planning. The facilities department developed a facility database that started at 2.5 million square feet and will almost double in the next 10 years. A Web site was also created to support this effort (dacnet.rice.edu/maps/space/).

The first step in developing the space inventory was to organize and transfer all the facility drawings into CAD. The facilities department started looking for a computer-aided facilities management (CAFM) system in 1990.

In 1995, the first computerized space inventory was published and each division representative was trained on how the system worked and the way information was updated. This step was very time consuming but necessary.

The next step was to upgrade the software to the most current version so that we could save time and produce reports directly from the system. We had to use several software packages to get the final reports to the users. Upgrading to the new system took a lot longer than expected, but we were able to see the benefits immediately. The facilities department was able to make the next yearly update more quickly.

The last step in the process was to consider using the Internet to provide users with the information. In 1996, we started investigating ways of making floor plans and standard reports available to users over the Internet. We developed a basic Web site that went online in the fall of 1996. Since then, the department has been adding features and perfecting the Web site and the update process.

Approved users are now able to learn online how much space they have, view and print appropriate floor plans, and query the system for information. The information is in real-time and is updated as changes occur. This Web planning tool allows users to better convey their space needs to the facilities department and administration.

The drawings and initial database took approximately five years to implement, with one project manager and approximately five CAD operators. The update process took about three years to complete, with one project manager and division and department coordinators. The Web pages took about one year to complete, with a project manager and several part-time students.

Process

With the automated space inventory update process, keeping track of Rice's space is much easier. The system is used for such things as space planning, remodeling projects, indirect cost reporting, strategic facilities planning, and programming studies for new buildings. The drawings and databases are updated continually, with a formal update once a year. The information is posted on the facilities Web pages so that all registered users have access to real-time current information.

Users make two types of changes to the space inventory:

1. *Physical space changes.* These changes (e.g., moving walls and doors) usually come through the facilities office, and the CAD department is notified and updates the drawings and database.
2. *Organizational changes and changes in space use.* These changes (e.g., people, departments, and space use) usually originate from individual departments. Each division and most departments have a designated representative who notifies the facilities CAD department so that the drawings and database are updated.

Campus users who have a password for the system can log in, view, and print floor plans and reports and query the database. Rice is modifying the system so that users can make changes directly to the system by logging onto the same facility Web pages.

This online system has made determining space assignments and space needs much easier and an integral part of the facilities planning process. Indirect cost reporting is now simpler and faster than before. This system also allows Rice to compare its space to similar institutions for benchmarking and strategic facilities planning.

Technology Impact

The CAFM software and, most importantly, the Internet have made the process of updating and planning space assignments simpler and faster than before. Campus users are now more likely to understand the amount and quality of space their group or department has. They are also better able to communicate their needs to their deans and vice presidents. This, in turn, makes the facilities department job easier when it comes to remodeling existing space or planning new buildings.

The following planning practices have been affected by this new automated system:

- Space inventory update
- Space assignments
- Indirect cost reporting
- Programming for new buildings
- Benchmarking with other institutions

What Worked

Deciding to publish the space inventory information over the Internet was the best thing we ever did. In the past, getting standard drawings and reports to campus users for their individual planning was a full-time job. The facilities department was responsible for supporting departments' efforts to understand and plan their space. By publishing the information over the Internet, we were able to save time and money because departments could now do most of their own information gathering online.

Current changes include allowing users to make changes directly to the space database. One problem that the facilities department is working on is making sure that the user change is reviewed before submission to the database. This involves a virtual table of information in the database that the database administrator reviews and approves. The system now requires a part-time database administrator, two part-time CAD draftspersons, and a part-time Web master.

Most campus users and facilities staff depend on this system to accomplish their everyday facilities planning tasks. Department heads are able to pull up information about their space, facilities staff access information for space assignments and location, and auditors can view information about space usage for indirect cost reporting. This is all done in the background and without much effort spent on the information-gathering stage. Campus users can now concentrate on their planning tasks rather than spend time trying to find information.

Lessons Learned

One of the lessons we learned had to do with the difficulty of training the 35 to 50 users who are responsible for updating the space inventory. The way in which the information is updated is critical, and the space planning process is totally dependent on accurate information. A user who feels the process is difficult and time consuming is more likely to pay less attention to important details. Therefore, we made updating information as easy and as accurate as possible. And in an effort to use technology to make the update process easier, we changed the way updates were turned over to the facilities department. In the past, users required training every time the process was changed, and it got to be confusing after several changes.

Another lesson we learned related to Internet technology and how quickly it can change. We started about four years ago and wanted to publish drawings on the Web. It was very time consuming to export drawings, and we found that each year that passed new technology was developed that made it easier. We asked ourselves whether we should wait until the technology was available or whether we should do what we could with the available technology. We chose the latter. For example, if you log on to our Web site, you can see that we have floor plans available on three different formats.

We believe it was wise to choose available technology to achieve as much as we could. That way, year after year we had an opportunity to use new technology at the same time the Web site was upgraded.

Patricia C. Williamson

Planning Practice

HOUSTON COMMUNITY COLLEGE SYSTEM

NEW TOOLS FOR COMMUNITY COLLEGE FACILITIES PLANNING

Patricia C. Williamson, vice chancellor for institutional development, Houston Community College System, is responsible for planning, research, resource development, and information technology. She was previously vice chancellor for student services. This is her first publication in the field of planning; she has recently presented at national conferences on facilities planning and institutional effectiveness.

By their mission, community colleges serve the needs of their local communities. In developing long-term strategic and facilities plans, they must be able to project demographic changes accurately in their communities. In large metropolitan areas, where a community college district might operate multiple campuses and facilities, the college must anticipate shifts in population and educational demand within its service area. Recent advances in desktop mapping technologies using geographic information systems (GIS) and access to detailed census information and projections have added a dimension to facilities planning heretofore extremely limited.

Houston Community College System, five colleges serving 53,000 students in 25 facilities throughout the Houston metropolitan area, used these and other analytical tools and technologies in creating a 10-year facilities master plan. The plan involved developing a series of databases and planning models to ensure that the final facilities plan would be data driven, dynamic, and responsive to a changing community. The databases and models include the following:

- A complete inventory of the square footage and seat capacity of every facility, owned and leased, in the system.
- An area summary analysis model comparing each college facility with benchmarks developed from Texas Higher Education Coordinating Board space guidelines and state and national peer institutions based on differing programmatic space requirements.
- A utilization and facilities capacity model, which analyzes enrollment and class scheduling data to determine the utilization of each classroom and anticipates the head count that can be accommodated within each facility. For each of the facilities analyzed, the following two guidelines were established: (1) target utilization based on CEFPI and coordinating board standards and (2) theoretical maximum capacity—the practical limit at which students might feel crowded and enrollment might be negatively affected.
- Population planning maps using MapInfo's GIS program to pinpoint current, planned, and proposed facilities on maps of the HCCS service area. Two sets of thematic maps were prepared. The first set of maps, each ranged by census tracts, depicted the 1997 population density estimates and the 2002 population density projections. Data for both maps were based on 1990 U.S. Census Bureau data, with estimates and projections by Equifax and the Wharton Econometric Forecasting Associates. The second set of maps, each ranged by regional analysis zones, depicted 1997 estimates of jobs and 2002 projected jobs. Regional analysis zones

are neighborhood-combined census tracts. The Houston-Galveston Area Council provided both the zones and the job data. Using MapInfo, a four-mile-radius zone was created around each major campus site. Small sample regression analysis confirmed the four-mile area to have the greatest demographic impact on campus enrollment. Population and employment shifts within the zones were analyzed. Similar analyses were also performed for new campuses scheduled to open and for several potential sites.

- A 10-year enrollment projection model by site, which uses a combination of enrollment projections the state developed for the system as a whole; projected demographic shifts within the district; and assumptions regarding the impact of opening, closing, and relocating facilities based on historical enrollment trends. Each of the factors and assumptions can be changed for scenario planning purposes. The enrollment projection model also quantifies an estimate of the unserved market. Using enrollment data from peer institutions and census data in comparable urban areas, peer institution penetration rates were calculated and compared with HCCS's current penetration rate of 3.7 percent. Based on comparables, HCCS established a potential penetration rate of 4.7 percent for calculating the unserved market.

The capacity model and enrollment projection model were combined to project when each facility would reach target utilization and theoretical maximum capacity. At target utilization, the system should begin expansion plans for that facility, and at theoretical maximum capacity additional space must be made available at that or a nearby facility. Although used widely in marketing, the concept of penetration rates is very new in the study of community college enrollments. By factoring in unserved market estimates, the district is assured that it can justify expansion and does not overbuild systemwide. These models and their outputs were used extensively in both the needs assessment phase and the project ranking phases of the planning process.

Process

The master planning process was inclusive and comprehensive. The Board of Trustees commissioned the process, and a member of the board and a system vice chancellor co-chaired it.

External system architects managed and documented the process, which involved the board, system and college administration and staff, and community advocates. The planning process ensured that the plan was data driven. At the same time, it recognized the subjective, often political, nature of facilities planning and incorporated that reality into the process, ensuring its widespread acceptance. The process included the following four steps:

Step 1: Establish the vision and guidelines
Step 2: Determine needs
Step 3: Assess options
Step 4: Develop the plan

The initial process began in June 1998 and was completed in April 1999. The first update and revision took place in spring 2000, incorporating fall enrollment data and capacity revisions resulting from major facilities expansions completed in the fall.

In step 1, the facilities plan was linked to the institutional strategic plan, and a set of facilities planning assumptions and principles was developed, disseminated widely for comment, and adopted by the Board Facilities Committee (which included staff). Each college then held visioning sessions with faculty and staff to identify college needs and wish lists. The committee refined these lists and incorporated them into the plan vision and goals.

In step 2, the system architects and the Office of Institutional Research gathered and analyzed all of the benchmark and internal data and developed the models. In addition, system architects, consultants, and staff undertook a detailed facilities assessment of owned facilities to identify life safety, regulatory, and critical building maintenance needs within the system. They identified $2.9 million worth of critical building issues and $9.7 million worth of high priority items.

In step 3, based on needs for additional teaching capacities and new programs, a list of 25 potential projects was developed. The projects were quantified by estimated size, cost, and new students who could be accommodated. After detailed presentations of all the data and models, the Executive Committee—consisting of the chancellor, college presidents, vice chancellors, and the chief financial officer—ranked the projects three times based on the following:

- *Strategic positioning:* the degree to which the project would position the institution to reach its long-range goals and vision.
- *Qualitative concerns:* the extent to which the projects would improve the educational experience at HCCS.
- *Quantitative concerns:* the degree to which enrollment projections and capacity utilization analyses supported the project.

Based on weightings of 25 percent, 35 percent, and 40 percent, respectively, an overall administrative ranking was finalized. The Board of Trustees was then provided with the administrative ranking and asked to individually perform the same three-step ranking process.

In step 4, the full board received the administrative and individual board member rankings and was asked to develop the final ranking and potential priority list for a general bond election. The final ranking was established, although the cutoff and size of the bond referendum had not been finalized as of the date of publication of this book.

Technology Impact

Technology not only influenced the development of the facilities plan, it made it possible. Technology has also provided the means to ensure that the process is flexible and continually updateable as circumstances, enrollments, and facilities change.

For the facilities utilization and capacity models, PC databases and spreadsheets replaced mainframe-based facilities and room inventories, making possible accessible, updateable data that can be manipulated easily. For an institution as large as HCCS, with multiple sites and numerous people responsible for updating facilities inventories, the PC has made the update process manageable for the first time and, as a result, has generated confidence in the data. The next step in guaranteeing up-to-date inventories is to make all inventories Web-based.

PC spreadsheets also facilitated the development of 10-year enrollment projections. For more than 40 facilities and off-campus units, historical enrollments were obtained from the mainframe registration system. Historical trends were easily analyzed and combined with demographic projections to produce prediction formulas by site. As actual enrollment data is generated each semester, both the data and the formulas are easily modified, enabling updated and increasingly accurate projections.

By far the most important technology tool to support the planning process was MapInfo's GIS desktop mapping program. A GIS-produced map is really a series of overlaid maps built from standard or modified map data (borders, roads, and points of interest), census information captured by census tract boundaries, and/or other local or college proprietary data. One of the more effective GIS tools is thematic mapping, which provides a layer of different shadings or patterns on the map, allowing one to visualize the underlying data. The ability to visualize the technologically combined data from impartial and reliable sources supported a more data-driven facility planning effort.

What Worked

The formalized process that provided opportunities for widespread involvement by all constituencies was an important key to success. HCCS has an elected board of nine single-member districts with the expected political pressures. Having a board member as co-chair and having commitment from the chancellor to see the process through were important factors both in keeping the process on track and in gaining final acceptance of the plan. Ranking the strategic concerns legitimized the political considerations in facilities planning.

Using external system architects as consultants was one of our wisest decisions. They brought knowledge, experience, access to benchmark data, skill, and staff to the inventory, assessment, space utilization, and capacity modeling processes. But, most importantly, they provided neutral oversight to what can be a highly charged, political process. This neutrality helped with acceptance of both the process and the final plan. Now that the plan and models have been put into place, our Office of Institutional Research and Department of Facility Management can easily maintain them. The extensive use of technology and data helped ensure that the plan is grounded in fact. A previous facilities plan developed in 1992 before a failed bond referendum was based on wishful projections masquerading as real data. The technology also allowed the planners and the board to develop "what if" scenarios throughout the process, helping them to understand the impact of various options. The data, particularly the enrollment projections, are being used extensively throughout the system for a variety of purposes. By far, the most successful use of technology was the mapping. Not only did it provide vital planning data, it allowed the majority of constituents—including the board, who do not have the time or the desire to delve into the massive data produced—to visualize key data elements. Creating and thematically mapping four-mile-radius service zones around facilities has provided a graphic rationale for facility location or expansion and has enabled planners and the board to envision options. The maps and the data produced have generated widespread interest in the plan. State officials and the metropolitan chamber of commerce have requested copies, and a major Houston university used the information in a presentation to its board regarding a satellite campus.

Both the process and the data have provided the plan with the credibility necessary to expand our tax base to out-of-district areas in our service area and to generate community support for a bond referendum.

Lessons Learned

Probably the most important lesson we learned was that data is both powerful and threatening. Early in the process, when data started to flow, many constituents began to question the validity of the data and assumptions, primarily because they feared that decisions would be based solely on data that did not seem to support their interests. These fears threatened to derail the process on several occasions. With the strong support of the chancellor and the determination of the board member serving as committee co-chair, the process was completed. Once it became clear that the data were only one of the important considerations that would be used in establishing the final priorities, fears were calmed and the data achieved greater legitimacy. If we were to do it again and had the luxury of time, we would develop all the databases and models and gain buy-in first.

The second important lesson is not to assume everyone is as interested as you are in all the data. By providing multiple levels of data, from the very detailed to the simple visual, we were finally able to meet most peoples' needs. People will, however, become much more interested in data once they see it being used. We had no trouble getting campus personnel throughout the system to update their space inventories once they realized the inventories were being used to allocate new facilities.

On the other hand, most people will be interested in only the data that address their current situation or problem. We received criticism from some campuses that enrollments were under-projected when new facilities were at stake; now with pressure to increase enrollment, the same constituents have complained that some enrollments were over-projected. The key to answering these criticisms is making sure the data are constantly updated. Already, we have faced capacity projections that have been questioned because of changes in room design made during construction of new facilities. We are able to revise the facility capacity immediately. It is true with any plan, but especially in an environment subject to rapid change, that the data that drive the plan must be accurate and up to date. If not, that will be an excuse to ignore the plan.

Theoretical maximum enrollment is an important concept for facilities planning, but it has been confusing when enrollment projections have been used for other purposes. For facilities planning purposes, we capped the site enrollment when theoretical maximum capacity was reached. However, as any good community college administrator knows, you can continue to cram students into a facility by all sorts of creative means. We need to refine these projections in a way that reconciles this reality with the model.

Finally, we must continue to refine the models, especially enrollment projections by site. In fall 1999, with the opening of six new facilities, the projections were close, but not 100 percent. At the end of the term, when all registrations had been completed, the data were updated and 10-year projections revised. This must be an ongoing process. The final step will be geocoding students enrolled at each site and each program to further refine the projections and to provide a visual depiction of enrollment patterns.

Key participants in the 10-year facilities master plan also included James R. Murphy, Houston Community College System Board of Trustees; Margaret Drain, Research Associate; and the PageSoutherlandPage team of Kurt Neubek, AIA, Thomas McCarthy, AIA, and Julie Newkirk.

Conclusion

Realizing the Vision: Concluding Thoughts

The authors in this book provide an abundance of ideas, plans, strategies, and implementations of institutional missions and visions. How did these institutions realize their visions? Most of these successes were due to a concentrated, collaborative, directed effort on the part of many stakeholders. Most of these stories provide good examples of the principles of strategic planning and change creation, as described in Part 1. There is one other success factor: developing and building a shared mind-set. One of the tools for a common mind-set is shared language, which supports effective communication about the goal, the strategies, and the outcomes of a plan. Although a common vocabulary, a common language, may appear to be a simple, even mundane concept, we believe that its criticality in successful planning efforts should not be overlooked.

The vocabulary and language of planning provide the basis for improved communication at every level of the institution. The best visions are able to encapsulate in concrete, concise terms. A vision should be memorable enough that all stakeholders are able to recite it like a mantra. Short, concise visions and slogans provide focus and energy with effective language. Recent social marketing campaigns such as that of Mothers Against Drunk Driving ("Drink, don't drive!") or against illegal drug use ("Just Say No") are examples of focus and memorability. Sharply focused mission statements might include tag lines, such as "provide high quality education to working adult students" or "prepare students for successful professional careers through programs of exceptional quality that integrate theory with practical experience." As a general rule, shorter statements are better. The visions, principles, and practical applications detailed by the authors in this book can assist you in planning and implementing the changes in your institutions—changes being driven by emerging and converging technologies, by a reexamination of teaching and learning methods, and by an increasingly competitive environment. The shared experiences of the authors lead to important conclusions that we believe are important for all change leaders and followers.

In the Introduction, "Framing the Vision: From Principles to Practice," we identified three major themes that run throughout this book:

- Planning takes place at many levels in the organization.
- Life-cycle planning of multiple institutional components is critical.
- Institutions are harnessing the power of technology to accomplish and expand their visions and missions.

The comments in this conclusion address each of these themes and refer back to some of the key concepts that we think are useful in creating and implementing institutional plans. In addition, and perhaps most importantly, we suggest that the three themes are strategically interdependent. Taking advantage of this interdependence can strengthen the effectiveness of your future planning.

We suggest that each reader interpret the principles and strategic messages of the authors, each from his or her unique institutional perspective and within the common framework of higher education's role in society. We hope these messages are transcendent and provide strength for all readers' future planning efforts.

Organizational Levels for Planning

Organizations that achieve planning success (i.e., changes are planned and successfully executed) employ techniques to reflect a notion of their role in society and in so doing include members of the college or university community along a spectrum of organizational levels. They exhibit buy-in and sponsorship at the highest possible level. They provide continuous support from the highest levels to the operational levels charged with implementing change. They identify important stakeholders and include them in planning processes. They understand that success in creating change is highly dependent on the participation of these stakeholders. They clearly identify the key roles in the change process.

Planning occurs at many levels—societal, institutional, work group, and individual. In chapter 1, Roger Kaufman and Dale W. Lick advise us that we need to understand the processes and outcomes associated with each level of planning in order to make a positive impact on society and to realize our visions.

They also suggest that our visions and values, while needing periodic review, remain constant over time and provide us with the foundation for plans and progress toward meeting goals and realizing outcomes. Their concept of mega-level strategic planning suggests that planning must take place with a mind-set that includes "an ideal vision" for the institution.

Several chapters in this book describe change at the institutional level. In chapter 3, Gretchen M. Bataille suggests that institutions shed old notions of academic planning and embrace the benefits that technology can bring to learning environments, that institutions seek out partnerships to take advantage of the increasingly competitive higher education world, and that institutions reconfirm their responsibility to ensure that education is available to those who seek knowledge. J. Thomas Bowen, in chapter 4, also provides an institutional planning perspective. His contribution is grounded in the realities of today's challenges. It's almost as if he's saying that change is all well and good, but it's not as easy or as obvious as it looks. He's probably right, and he's not alone. Lick and Kaufman's change creation model as explained in chapter 2 provides step-by-step guidelines for creating successful institutional-level change.

In Chapter 5, David G. Brown's approach to academic planning is an example of institutional-level change that identifies and involves key stakeholders in the change process. His change creation principles echo those of Lick and Kaufman.

In chapter 6, Ellen-Earle Chaffee's description of institutional-level planning provides us with an executive view of institutional-level change in the form of potentially risky laptop initiatives that were, ultimately, well planned and executed. Again, it is the involvement of the institutional community that makes these efforts a success.

At a more operational level, several authors relate experiences in working to change the curriculum through the use of technology (see John E. Kolb, Gary A. Gabriele, and Sharon Roy in chapter 7 as well as John T. Harwood in chapter 8). Others provide us with insight into technology planning at the IT organization level (see John W. McCredie in Chapter 9, Christopher S. Peebles in chapter 10, and John F. Moore and J. Thomas Head in chapter 11). Still others examine the juncture of the physical plant and the digital plant in the planning of technology-intensive spaces (see Joel L. Hartman in chapter 12, Margaret McDermott and David E. Hollowell in chapter 13, and Bruce M. Taggart in chapter 14).

The perspectives evident in all these planning experiences remind us that involvement of the right set of stakeholders and assignment of accountability are key elements in successful planning no matter what the organizational level. In addition, planning efforts must recognize the reality of resource constraint. As at Valley City State University and Mayville State University (see chapter 6), bold steps are sometimes taken to overcome resource barriers. It was the willingness at multiple organizational levels to find a way to make the laptop initiative work that made it a success. The president of these universities could not have single-handedly effected such a change. This is the classic case of planning directing resources toward the priorities of the institution.

Life-Cycle Planning

A key theme addressed throughout this book is the concept of life-cycle planning, a simple concept. Organizations, processes, activities, physical facilities and spaces, the curriculum, and computing equipment all have a set of phases (the life cycle) through which they pass. These phases generally reflect a beginning (adoption, creation, setup, or acquisition), a middle (normal operation, upgrade, or renovation), and an end (disposition, demolition, or replacement) of useful life.

While some chapters (those by Kolb et al., Harwood, and Peebles) address life-cycle planning directly, others allude to the need to think in terms of useful life, particularly of technology tools and equipment. In fact, the change brought about by rapidly evolving technologies has created an awareness of life cycling not previously experienced in higher education planning. The term "recapitalization" has crept into our vocabularies in the past decade or so. It would be surprising to find a faculty member, dean, or other administrator who does not recognize the term and/or express a concern for the renewal of computer equipment and software. This interest in renewal of technology-related resources (including such things as infrastructure, staff development, equipment replacement, software upgrade) has brought with it an interest in the freshness of the curriculum, the appropriateness of teaching and learning spaces, and the need to examine the current status of institutional missions and ideal visions. The concept of life cycling is becoming increasingly important in all areas of institutional planning. The institutional commitment of resources to life cycling is not an insignificant component of life cycle planning; in fact, one could argue it is *the most critical* component. In the absence of a commitment to renewing key supporting elements of mission and vision (such as technologies), stagnation will inevitably occur.

Employing Technical Innovation to Support Change and Achieve Visions

This book is brimming with the employment of technical innovation that supports change and leads to achieving ideal visions. From new designs in instructional spaces (Part 4) and the curriculum (Part 2) to strategic use of technologies to meet university missions and goals (chapters 3, 5, and 6), examples of the innovative approaches to planning and implementing plans abound. The enthusiasm for embracing the future armed with new tools and insights is visible in the guidance offered to help find new ways of accomplishing goals. In some cases necessity *is* the mother of invention—of having to figure out how to do more with no additional resources. In other cases, it is simply a matter of thinking smarter, of realizing that the needs of our students can be met by applying to the learning experience those tools that students are beginning to take for granted. Students expect connected residence halls and computing labs with the latest equipment and software. Their use of e-mail is truly ubiquitous. They, and the tools of technology, are helping to pave the way to increasing innovation in the curriculum, to technology-rich spaces, and to institutional visions that embrace a future of anytime, anywhere, "anywhile," lifelong learning.

Interdependence of Planning Themes

As you conclude this book, we hope that you will leave with a framework of thought that these three planning themes—multilevel planning, life cycling, and the use of technical innovations to achieve missions and vision—are critical to realizing the "ideal vision" and that these three planning strategies are also quite interdependent.

While there is a need to include an appropriate set of stakeholders in the planning process, whether it be at the institutional level or below, that planning process is the vehicle, in many cases, by which the useful life of organizational programs and features are determined. In addition, the planning process is where decisions about investment in and support of technologies occur. Without the proper infrastructure in place and a commitment to renewing the exhaustible resources needed to keep the infrastructure operational, planning efforts are nothing more than exercises in futility.

One might consider institutional planning processes as the confluence of life cycles in time, place, mission, and need. That is to say, when the appropriate stakeholders do come together with an ideal vision in mind at the right time, in the right place, with a specific mission, and a process for change creation, they do create effective change. They make things happen. They lead; they transform; they succeed! We sincerely hope that you will find the experiences from these authors helpful in reaching your ideal visions.

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About SCUP

The mission of the Society for College and University Planning is to promote the advancement and application of effective planning in higher education. SCUP members span multiple planning disciplines—from facilities, academic, and information technology planning to fiscal and resource allocation. All types of institutions, systems, governing boards, and commercial firms share the philosophy that cross-boundary planning is integral to the health and vitality of higher education.

SCUP was founded in 1965 and has 4,300 institutional and individual members worldwide.

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Mary Doyle is director, information technology, at Washington State University, where she is responsible for computing and telecommunications in network and telephone services; administrative systems, including application development and support, enterprise computing, and production control; platform services and support; general university classrooms; student computing services, including open access computing labs, residence hall technology services, and student help desk operations; IT graphics; and technical assistance for faculty and staff. Previously, she served as assistant provost, College of Letters and Science, at the University of California, Santa Barbara. She has participated in a number of SCUP activities, serving as Pacific Regional representative as well as in various committee roles. She is also a member of the board of directors of the Northwest Academic Computing Consortium and serves on various conference planning committees while maintaining active memberships in other professional organizations. She holds a bachelor's in computer information systems and an MBA from Arizona State University and a Ph.D. in educational leadership and organizations from the University of California, Santa Barbara.

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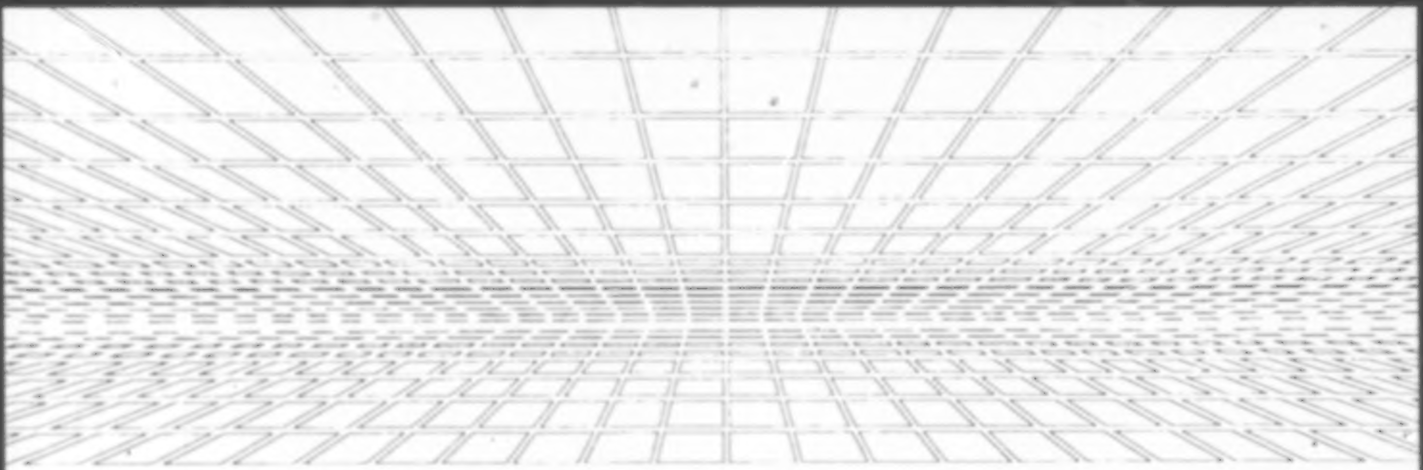

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